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AN

INTRODUCTORY OUTLINE

OF

THE PRACTICE OF

SHIP-BUILDING,

&c. &c.

BY JOHN FINCHAM,

SUPERINTENDANT OF THE SCHOOL OF NAVAL ARCHITECTURE IN

PORTSMOUTH DOCK-YARD.

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1821.

TO THE

REVEREND JAMES INMAN, D.D.

PROFESSOR OF THE ROYAL NAVAL COLLEGE AND SCHOOL OF NAVAL ARCHITECTURE

IN PORTSMOUTH DOCK-YARD.

REVEREND SIR,

IF the instruction given in these establishments, on the subject of Ship Building, should be at all facilitated by the following short Outline, it is owing to the influence of your counsel and support. I embrace, therefore, this opportunity of acknowledging it; as well as the assistance and encouragement you have always afforded me; and of expressing the sentiments of esteem and respect with which I am,

Reverend Sir,

Your most obedient Servant,

JOHN FINCHAM.

School of Naval Architecture,
Portsmouth Dock-Yard, Dec. 17, 1821.

ADVERTISEMENT.

The Author of this Introductory Outline of the Construction of a Ship, in the execution of his duty, has to instruct the Students at the School of Naval Architecture at Portsmouth, in the Practice of Ship Building; he also gives occasional explanations on the same subject to the Students at the Royal Naval College. He has printed the following outline, under the hope that it will prove useful to both Establishments; to the former, as affording some little assistance in overcoming the first steps in the practical part of their profession; and to the latter, as containing probably sufficient for their present information.

In the first part, he has explained the general connexion of the several principal parts of a ship, from the keel upwards. Secondly, he has entered somewhat more at large into the description of the different timbers which compose the various parts, and the manner in which they are put together and fastened, both in the old and new mode of building. Thirdly, he has given some instructions relative to mast making. And lastly, he has added a short Vocabulary of the principal English terms used in ship building, together with the corresponding terms in other languages, which last he has thought may prove useful to officers on foreign stations.

The figures at the end, referred to throughout, have been struck off from the lithographic press, as they were given in the examples to the Students, and are therefore perhaps not quite so correct as might be wished; although it is hoped that they are sufficiently so for the purpose of general instruction.

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A GENERAL DESCRIPTION

OF THE

SEVERAL PARTS OF A SHIP.

1. The body of a ship, exclusive of its furniture, is called the hull; which is distinguished by the part under water, called the bottom or quickwork, and the part above, called the upper-work or deadwork.

2. The mode of giving and preserving the different parts will be explained here generally and hereafter more fully.

3. The longitudinal form is determined vertically, by timbers called the keel, (Fig. 2, 4, and 9, *a*) stem, (Fig. 4 and 9, *b*) and stern post (Fig. 4 and 9, *c*). The stem which is at the foremost extremity is supported in its combination with the keel, which is the lowest part of the structure, by other timbers lying in its concave part, called the apron (Fig. 2 and 9, *d*) and stemson (Fig. 9, *e*): the apron and stemson unite with timbers called the deadwood (Fig. 2 and 9, *f*) and keelson (Fig. 9, *g*), which timbers give support to the keel: the stern-post, which is at the aftermost extremity, is supported by timbers called inner stern-post (Fig. 4 and 9, *h*) and sternson (Fig. 9, *h*), and these timbers likewise form a junction with the

keelson, deadwood, and keel, so that a mutual connexion is kept up by them to preserve the longitudinal form.

4. Transversely the form is given and an union formed, vertically by a number of assemblages of timbers called frames. The lowest timbers in these assemblages, called floors (Fig. 10, *m*) are connected with the deadwood, and lie between the keel and keelson, extending equally on each side; other timbers, in conjunction with these, called futtocks (Fig. 10, *n*), unite the immersed part with the upper works, and keep up a connexion from the keel to the timbers that form the upper boundary of the structure, called gunwales (Fig. 10, *o*) and plank-sheers.

5. The longitudinal form is further maintained, and connexion preserved, by exterior and interior linings, called planking (Fig. 10, *p*), and interior binders, called shelf-pieces (Fig. 10, *q*), united to the frames. The exterior lining or planking (Fig. 10, *r*), which is connected with and covers the whole surface of the frame, is made water-tight, to preserve the buoyancy of the body. The interior lining (Fig. 10, *n*) is connected to the frames by the same fastenings that connect the exterior, by their passing through both and the timbers.

6. The transverse form is further preserved, and the connection of the two sides kept up, and to their proper distances, by timbers lying horizontally, called beams (Fig. 10, *s*); these beams are firmly united to both sides of the ship, several ranges of them forming the principal support of

the platforms, called decks (Fig. 10, *t*), for the different batteries, having a fixed depression below the ports, according to the calibre and species of ordnance; the lowest gun-deck being placed in relation to the water's surface, that the ports may be sufficiently high above the water to fight the guns; the others are governed by the heights between the decks. The beams that are below the batteries are for decks, either for the accommodation of the ship's company, or for placing the stores.

7. In three-deck ships, the different decks for the batteries are distinguished by the lower, the ports of which are about six feet from the water; the middle and upper deck; quarter deck, forecastle, and roundhouse, in general called poop. Below the lower gun deck is the orlop; the midship part of this platform is for stowing the cables, the extremities for store rooms and cabins for the accommodation of several of the officers. Two-deck ships have no middle deck. Frigates have only the upper deck, quarter deck, and forecastle as batteries; the lower deck is for the accommodation of the ship's company; below the lower deck, in the larger class of frigates, in midships is the orlop, for stowing the cables; at each extremity, separate from the orlop, are the fore and after platforms, for the different store rooms; between the after platform and orlop is the after hold; and between the orlop and fore platform is the fore hold; the after hold is for stowing part of the provisions; the fore and the main hold, which is under the orlop, is for stowing the water.

Certain classes of ships have the same decks as frigates, the orlop excepted; in which case the

cables are generally stored in the main hold. Flush deck vessels, as corvettes, brigs, and cutters, have only one deck as a battery, the upper deck: and one deck for accommodation and stores, the lower deck.

8. The beams that form the transverse ties are disposed, on the different decks, so that their sides may form the hatchways and ladder-ways, or the communications with the holds, and from one deck to the other, to give support to pieces fixed to them, called mast partners, for wedging and securing the masts, and to pieces fixed to them, called riding bitts, for securing the cables when the ship is at anchor. The beams are placed, one nearly under, and one between every port; the beams of every deck are placed immediately over each other, that the lowest deck may receive support from the keelson, by pillars placed upon it at the middle between the sides; the decks above are supported from each other.

9. To assist in connecting the beams to the side thick longitudinal pieces are united to their ends and to the sides of the ship, called water ways (Fig. 10, v); upon the beams, from side to side between the water ways, either longitudinally or diagonally, a flat is laid; when it is longitudinally, the whole of the breadths, called strakes, that compose it are laid in a direct line from one extremity to the other; when diagonally, two strakes, called binding strakes (Fig. 10, x), are laid longitudinally close to the hatchways, and between them the flat is laid with the strakes, lying at an angle of 45° to a fore-and-aft line.

10. To give sufficient support to the flat between the beams, to support the artillery, and to give firmness to it when the edges are caulked (Note 1), (as the whole of the decks exposed to the weather or the encroachment of the sea, are made water-tight) half beams are placed between them, supported at the side end by the shelf or an interior plank, called clamp (*Fig.* 10, *z*), and the midship ends by pieces lying longitudinally let into and fixed between the main beams, called carlings; these longitudinal pieces form likewise the sides of the hatchways where they come in their wake, but between the hatchways they are placed at the middle line.

11. When the flat is laid diagonally, pieces, called ledges, are placed between the main and half beams, and let into them, at right angles to the strakes for supporting the flat when the edges are caulked.

12. Below the lower deck, in two-deck ships and upwards, upon the inside planking, were formerly placed interior frames, in the full part of the body, extending from the keelson upwards to the lower deck beams, called bends of riders, the lowest timber called the floor rider, extended equally on each side the middle; the other timbers according to their position with this, were called, first, second, and third futtock riders. These timbers were for supporting the body against the upward pressure of the fluid and when the ship takes the ground.

13. Another principle of support has been introduced, having for its object to prevent the

longitudinal straining, called hogging (Note 2) or arching, which takes place through the unequal distribution of the buoyancy of the body, compared with the action of the weights. This support is given by a trussed frame (Fig. 10) that is brought in contact with the frame of the ship ; the interior planking being left out from a small distance below the orlop down, and the openings between the timbers filled in and caulked. These openings are filled in to render more secure the bottom of the ship in the event of any disaster, to prevent decay by the exclusion of the impure air from the sides of the timbers, and to prevent the accumulation of filth in the openings, which may endanger the health of the crew by the noisome vapour arising from it. But another important advantage will be derived from filling in the openings, that of giving longitudinal strength, or a prevention of hogging ; for before the body can deflect (or what is technically called breaking the sheer) an extension must take place above a certain point within the body, called the neutral axis, and a compression below it ; (this extension and compression are quite evident in all ships that have broken their sheer to any extent). The body will therefore deflect in corresponding degrees as the parts above are extensible, and the parts below compressible ; and the neutral axis or point of revolution will be lowered or raised according as the resistance to compression or extension exceeds in influence upon the construction. Now as in the former mode of building, the resistance to compression existed principally on the planking, the timbers having but little else to prevent their mutual approach but the fastenings : whereas now, by the timbers being made a solid mass, the body is rendered as incompressible as the

nature of the substances of which it is composed will admit; consequently the resistance which the same surface opposes to compression is greatly increased, therefore the neutral axis must be lowered in order to equalize the moment of extension and compression round that line, and consequently since the resistance to deflection varies as twice the moment of the resistance to extension in each case (Note 3), the resistance to arching will be increased.

Definitions and Explanations of each Part of the Construction.

14. Ships are in general built upon inclined surfaces, called slips; the inclination to the horizon is about 4°. In the middle of the slip are placed short pieces of timber, called blocks, about 5 feet asunder and 4 feet long, with their upper surfaces in general to an inclination longitudinally with the slip, of $\frac{5}{8}$ of an inch to a foot, and horizontal athwart. This inclination need not be a standard under all circumstances, for the ship would be less strained, when there is depth of water to float before she sends, if the blocks were laid to such an inclination, that the light water line might be horizontal, or when there is shallow water, were the blocks laid to as great an inclination as possible; for by that means the after part of the body will sooner receive support from the fluid.

On the Keel (Fig. 1, 2, 4, and 9, *a*).

15. The keel is the first timber laid, and forms the lower boundary of the longitudinal section. It is one of the principals in the fabrick, and forms a basis for raising the superstructure.

16. To preserve this timber in a direct position upon the blocks, while building, a short treenail called a nag, is driven into these blocks on each side of it.

17. The keel is of elm, of which there are two sorts in general use, called the common and wych (Note 4); the common elm is mostly used for this purpose, as it is not of so fragile a nature as the other. It is of a parallel breadth or siding excepting towards the extremities, where it is reduced from two to three inches; the length of the tapering is 48 times what it is reduced.

18. As the keel cannot be obtained in one piece as to length, it is therefore composed of several, united together lengthways by what is called a side, or vertical, and coak scarph (Fig. 1, 2, and 3, *a*); the scarphs being in length about twice and a half the depth of the keel; the coaks (Fig. 3, *b*) are for taking the action of the bolts, especially a transverse action, when the butts of the scarph are caulking; they are one half the length of the scarph and their breadth one third its depth: the coaks are distinguished by the raised and sunk; the raised coak is upon the lip (Fig. 3, *b*) or thin part of the scarph, and the sunk (Fig. 3, *c*) coak taken out to correspond in the thick part; sometimes circular coaks have been introduced into a plane scarph; but as these coaks do not form a stop water, nor give such good support in the event of sagging taking place, they are not so much to be recommended.

19. The scarphs are bolted with from 6 to 8 bolts; 8 from frigates upwards, and 6 to smaller

vessels: half of the bolts are driven from each lip side with a ring upon the head, and clenched upon a ring on the opposite side.

20. The French and most other nations have flat or horizontal scarphs; but as these scarphs tend to weaken the keel, in the direction in which it is most subject to strain, more than the side scarphs, the English mode is preferable, for the keel bends vertically, which brings a tension on the upper or lower fibres, according as hogging or sagging takes place, which fibres are cut off, in a greater number in these scarphs, to let in the lips; and when sagging takes place there is a tendency to open the joint at the lower lip; this opening will cause the scarphs to leak, except a stopwater be placed at the intersection of the joint of the scarph with the outer edge of the garboard seam (Note 5), or by increasing the length of the scarphs.

21. The English or vertical scarphs have their upper and lower joints caulked with the same number of threads of oakum as the plank of the bottom, and when the upper joint is caulked, a batten $\frac{3}{4}$ of an inch thick and about 3 inches wide is let in over it, and its edges likewise caulked. The great pressure of the fluid upon the keel requires that every attention should be paid to keep them from leaking.

22. Out of the side at the upper edge of the keel, a groove (Fig. 11, *d d*) called a rabbet, is taken out to receive the edge of the lower strake of the exterior planking; this rabbet is taken out to an equilateral triangle, each side being equal to the

thickness of the plank; and after the ship is in a state of forwardness to require it, the upper part or what is called the back rabbet is made to conform to the body.

On the Stem (Fig. 2 and 9, *b*).

23. The stem is a circular timber connected with the foremost extremity of the keel, and extending to the bowsprit; its fore side forms the foremost boundary of the longitudinal section, and its sides terminate the fore ends of the exterior planking (Note 6), in a rabbet taken out for the purpose: this rabbet is formed the same as the rabbet of the keel (22).

24. The rabbet is taken out of the sides either upon the after edge or in the middle: in both cases it is made to conform with the rabbet of the keel when the stem and keel unite.

25. The stem is of oak timber with the range of fibre following as near as possible to its curvature, especially in the wake of the scarphs; its breadth or siding is given at the head where it is the largest, to give a firmer bed to the bowsprit, at the lower side of the lower cheek (Note 7) and at the keel, to which it corresponds.

26. Through the length and curvature of the stem, it is impracticable to provide it in one piece; it is therefore of two or three pieces (Fig. 2 and 9, *b* lower, *b′* middle, *b″* upper) united together by a flat and coak scarph (Fig. 2, *s s s*), the length of the scarphs bearing the same relation to the stem as those of the keel do to the keel, and also the coaks of the scarph.

27. The scarph that unites the stem to the keel (Fig. 2, *x*), is similar to the scarphs of the keel, excepting that it lets into the boxen (Note 8) left for the gripe, which gives it the name of the boxen scarph, and the piece of keel to which it is scarphed, the forefoot. This method of uniting the keel to the stem, though generally adopted, is inferior to the plan that has been introduced at times by the English ship builder, and more generally used by the French and other nations; that is, to have the foremost piece keel formed with a knee, or to partake of the curvature of the lower part of the stem, and to scarph to it with a flat scarph (Fig. 20). This plan is superior both as to strength and safety, when the ship takes the ground; for through the curvature of the lower pieces of the stem in the present plan, the grain is generally very short at the upper part of the lip of the scarph, which is the only part that is united to the long grained wood in the forefoot, which must evidently make it weak; while the boxen that is left for the gripe may become a complete barrrier, in the event of the ship's taking the ground, to her being moved a head, when the gripe is knocked off, until the forefoot is gone; which can only be carried away by some sudden stroke upon the ground, and not by any force used on board; whereas by making an abutment for the gripe, by forming the upper part of the false keel to the stem, when the gripe is carried away, the false keel will readily go to and free the ship.

28. The apron (fig. 2 and 9, *d*, *d*) is a timber conforming in shape, and fixed in the concave part of the stem, extending from the head to some distance below the lower scarph; it is for aiding

the scarphs and maintaining its shape. The scarphs therefore, called flat and plain scarphs (fig. 2, *u*) are placed between those of the stem, called giving shift to them.

29. That the apron and stem, when put together, may give the intended shape, the moulds (Note 9) are made to the right curve and to conform to each other upon the mould loft floor, so that when the timbers are formed by them, and placed in their relative position, the true form is obtained.

30. The apron is of oak, and when the rabbet is on the after edge of the stem, it is of a parallel breadth or siding, nearly equal to the stem at the head: but when the rabbet is in the middle it is made to correspond to the siding of the stem its whole length.

31. Before the apron is fixed to the stem, one bolt is driven through each lip of the scarphs of the stem, from the lip side, and clenched upon the stem; and when the apron is fixed, the remain bolts of the scarph are driven through and clenched upon it, which unites the stem and apron together sufficiently until the knee of the head bolts are driven (Fig. 9).

On the Knight-Heads (Fig. 17 and 18).

32. The knight-heads (Fig. 17, *c*) are timbers placed on each side of the apron when the rabbet is on the after edge of the stem; but when in the middle, they are placed partly on the stem, and partly on the apron. These timbers are for giving support to the bowsprit, and for rendering

more secure the foremost extremities of the exterior planking, called the wooding ends; they extend a sufficient height above the bowsprit to receive a chock over it (Fig. 18) and sometimes above the chock to form a timber head, and at other times to receive the planking for the forecastle barricading; they extend downwards if practicable below the lower deck. When the diameter of the bowsprit exceeds the siding of the stem at the head too much, so that the knight-heads would be cut considerably to allow the bowsprit to pass between them, which will take place in small frigates and all upwards, a piece is then introduced between the apron and stem and knight-heads, called a stem-piece, to give them more spread (Fig. 18, *m*).

33. The knight-heads and stem pieces are of oak, and are made conformable to the scantlings of the frame in and out, excepting wood is left on inside and out, called the boxen, equal to the thickness of the interior and exterior planking, in the wake of the bowsprit, extending from about one foot above to a foot below; this wood is left to prevent joints in the hole for the bowsprit.

34. The knight-heads and stem-pieces are bolted to the stem; when the body is not too acute, the bolts pass through both and the stem; but when too acute to pass through both, the bolts are driven from each side through one knight-head and stem only.

35. In addition to the bolts, several circular coaks are placed in the stem-piece and stem, and knight-heads and stem-piece.

On the Stern-post, (Fig. 4 and 9, *c*).

36. The stern-post (3) is a straight timber erected upon the after extremity of the keel, its after side forming the after boundary of the longitudinal section, its lower end uniting to the keel; and its upper end, in corvettes, brigs, cutters, and all flush deck vessels, extending of sufficient height to receive a brace above the upper deck (Note 10); but in larger ships, the upper end terminates so as to allow the tiller to work over it (Fig. 4, *x*) clear of the lower side of the upper deck beams (Fig. 4, *s*). This timber is of a parallel breadth or siding, from the head to the lower side of the deck transom (Fig. 7, *q*), if one; if not, to the lower side of the wing transom (Fig. 7, *m*), from which place it tapers to the lower end, where it corresponds with the keel.

37. The lower end of the stern-post is united to the keel in general, by two tenons (Fig. 5, *o o*), and one dove tail plate (Fig. 4, *s*) on each side. The tenons, which are to prevent the stern-post from working out of its position in relation to the keel, are about one fourth the depth of the keel in length, one third the breadth of the keel thick or athwartships, and about twice their thickness wide, or fore-and-aft; between these tenons the wood is left of the same breadth with them, about $\frac{3}{4}$ of an inch down, and to correspond with it, a groove is taken out of the keel so as to form a stop for caulking the abutment of the post. The dove tail plates (Fig. 4, *x*) which are to assist in firmly fixing the keel and stern-post together, are of a mixed metal (Note 11), and let in so that their outer surfaces may correspond with the outer sur-

face of the keel and stern-post, through which they are bolted with six bolts. The plates are let in immediately opposite each other, so as for the bolts to pass through both plates.

38. At the fore side of the stern-post is placed a timber of equal siding, called the inner post (Fig. 4 and 9, *h*), for aiding in the security of the wooding ends, and for letting the transom into (Note 12). The upper end of this timber forms an abutment under the deck or wing transom, and its lower end tenons into the keel with one tenon (Fig. 5, *z*) of the same dimensions as those of the stern-post.

39. On each side of the stern-post, a groove or rabbet is taken out to form an abutment (terminating at the line *q q*, Fig. 4) for the wooding ends: it is therefore taken out in depth equal to the thickness of the plank of the bottom.

40. The stern and inner post are of oak, and when practicable, the stern-post has the top end of the tree worked uppermost.

On the Stern Frame (Fig. 4 and 7).

41. The stern-post has several transverse timbers connected with it, called transoms (Fig. 4 and 7, *m n q g*); these timbers are at right angles to it, and extend equally on each side of it; the upper one is called the wing transom (*m*), and forms a basis for the stern; it terminates the tuck or ends of the exterior planking, at a parallel distance below the upper surface on the after side, called the margin (Fig. 7, *u u*), upon which, for forming

an abutment for the ends of the plank, a rail is fixed, called the tuck rail. The next principal transom below is called the deck transom (*q*), it corresponds in height and supports the after extremity of the lower deck, and has its upper surface of the same round up; this transom is always left as wide as possible for fastening the ends of the deck; between these two transoms, which are governed as to their situations, one or more transoms are placed, according to the distance between them, called filling transoms (*n*): the remaining transoms (g g g g) are distinguished by numbers according as they are placed below the deck-transom.

42. The whole of the transoms are of oak, and are scored (Fig. 8, *k k k*), and faced (Fig. 5 and 6, *i i i*) upon the stern and inner post to which they are bolted with one bolt passing through each, driven from the fore side of the transom and clenched upon the after part of the post.

43. Upon the ends of the transoms are fixed timbers, called fashion pieces (Fig. 7 and 8, *f f f*), having their outer surfaces corresponding to the form of the body; with the ends of the transoms, and with the plane of the sides perpendicular in relation to the keel, but oblique to the plane of elevation.

44. The fashion pieces (Fig. 4 and 7, *f*) are from one to three in number on each side. The foremost one extending above the wing transom, a sufficient height to form a scarph for a top timber and to bolt the heel of the side counter timber (Fig. 4 and 7, *c c c*); the second one forms an abutment under the deck transom; and if three, the after one

abuts under the third transom below the deck. The whole of them have their lower ends resting upon a stepping formed in the deadwood, to which they are bolted with one bolt that passes through each fashion piece and its opposite. These timbers are of oak, and where they combine with the transoms they are faced over the ends, and have one bolt driven into the end of each.

45. When the stern-post, inner post, transoms, and fashion pieces are united together, the whole combination is called the stern frame.

46. Through the expence and difficulty of providing timber suited for transoms, the whole of them of late, except the wing transom, have been substituted by timbers similar to the fashion pieces (*fff*), which form an abutment under the wing transom, and are continued to the stern-post.

On the Round Aft and Square Tuck.

47. The round aft and square tucks (Fig. 11 and 12), are assemblages of timbers at the after extremity, in the place of the stern frame (45) in sharp vessels, as brigantines, cutters, and generally yachts, and ships built of fir. When the buttocks are limited by the fashion pieces, or tuck timbers, in this assemblage, having their aft sides in the same plane with the after edge of the rabbet of the post, and the planks ending in a rabbet taken out of the outer and fore edge of this timber, the ship is said to have a square tuck: but when this timber, instead of its aft side being athwartships, is a portion of a cylinder with its axis parallel, and the vertex coinciding with the rabbet of the post, the ship is then said to have a round aft tuck.

48. The square or round aft tuck has the transom (Fig. 11 and 12, *a*) determined as to height, and fixed to the stern-post the same as the wing transom (43), but has its after side in the same surface as the fashion pieces either straight or cylindrical. The fashion pieces (Fig. 11 or 12, *b*) lap over the post in a rabbet taken out, nearly to the thickness of the plank of the bottom, to give sufficient caulking on each side, and meet at the middle on the fore side; they likewise halve (Note 13) upon the transom.

49. The fashion pieces are bolted to the transom at the place where they halve, with four bolts driven from the aft side, and clenched on the fore; they are likewise united together where they meet at the middle line by a dove tail plate (Fig. 12, *d*); two of the bolts that pass through the plate are placed so as to pass through the stern-post and clench on the aft side; the remaining bolts, which are two on each side, pass through the plate and fashion pieces only.

50. When the fashion pieces are bolted, the inner post is let over them and has two bolts to pass through it, the fashion piece, and stern-post, above and below the dove tail plate.

51. The transoms and fashion pieces are of oak, and on the aft side between them the space is filled in with oak plank, equal in thickness to the plank of the bottom (Fig. 11).

On the Deadwood.

52. The deadwood (Fig. 9, *f*) is an assemblage of timber (with its lower parts coinciding

with the upper edge of the keel, and extending from the apron to the inner post); for the seating of the floors, and giving the form of the body in the acute parts. The several pieces that unite lengthways are scarphed together by a flat scarph (Fig. 9, *x*).

53. At each extremity, the sharpness or fullness of the body determines the height necessary to be given to the deadwood, which is made up by placing several pieces one upon the other, continued above the line that terminates upon the deadwood, the form of the body called the stepping, or bearding line (Fig. 17, 18, and 20, *a*) to secure the heels of the timbers afore and abaft the floors, where they abut against the deadwood, and step upon a rabbet taken out from the bearding line upwards.

54. In disposing (technically called shifting), the deadwood, the several heights are made to form an abutment against the floors as they shorten (Fig. 9, *zzz*); the upper height at the foremost extremity abutting against the foremost floor (Fig. 9, *i*), and at the aftermost against the after floor (Fig. 9, *y z*); and the upper part making a fair curve with the upper part of the floors, called their cutting down (Fig. 9, *m*). The scarphs are shifted in the several pieces that unite lengthways, so as to be placed at some distance from those of the keel, and that their upper lips may come under a floor to prevent short grained wood, when the score is taken out.

55. The deadwood is of oak, and is only fastened to the keel, and the several heights to each

other, by two or three treenails in each piece, until the keelson bolts are driven. The after end of each height has a tenon into the inner post.

56. When the stepping for the heels of the timbers is not worked out of the deadwood, as in the new system of building, a piece to the form of the bearding line (Fig. 20, *c*) is brought in the side of the deadwood and treenailed and dowelled to it (Note 14).

57. In the after deadwood a knee (Fig. 9, *n*) is frequently introduced for uniting the deadwood to the stern-post, into which several bolts that pass through the deadwood are driven; otherwise they would fan too much, as the boundary of the keel and stern-post is much more than that of the keelson (Fig. 9, *g*) and sternson (Fig. 9, *k*), from the bolt in the after floor, which is vertical, and the bolt in the lower transom, which is horizontal. These bolts are driven in the knee before the deadwood that comes above it is brought on.

58. The deadwood in French ships partakes but little of the form of the body, not being of much more than sufficient height for stepping the timbers, which tenon into it in the acute parts. The after deadwood is formed by a knee *(d'etambot)* and one piece *(massif de l'arriere)*, that over runs the after scarph of the keel, and the fore deadwood is formed by a piece *(massif de l'avant)* that scarphs to the apron *(Contr' etrave)*, the apron giving shift to the lower scarph of the stem, and the deadwood over running the foremost scarph of the keel. The knee is bolted to the after end of the keel, and lower end of the stern-post independent of the timbers;

other bolts pass through the timbers and deadwood and into the keel, and horizontally through the timbers, knee, and stern-post, and forelock upon the foreside of one of the timbers.

59. Though there is little working, when afloat, in the neighbourhood of the deadwood, or little other strain than a compression, yet the manner of disposing it in French and ships of most other nations except the English, is little calculated to resist any force whatever; without considering the casualties of taking the ground, and knocking off any of the planks of the bottom, when the water would have a free passage into the ship; which is not the case in the English manner of disposing of the deadwood, being a complete stop in the sharp parts of the body, while the timbers are filled in and caulked in the full parts.

On the Floors.

60. The floors (Fig. 14, *a*) are timbers that score over and lay across the deadwood, which bisects them, and together with the keel are those timbers which will have to sustain the body when it takes the ground, and becomes inclined; they should therefore extend so far on each side as to be beyond (in the fullest part), where the body would come in contact with the supporting surface. These timbers extend in general towards the extremities, forward, as far as the foremast, and aft, as far as the square body extends, or as the acuteness of the body will admit of timbers being obtained with sufficient bend for them. But in the present mode of making floors (Fig. 16, *a b*), the providing timbers or the form of the body can present no obstacle to the

floors continuing as far to the extremities or out on each side, as any possible circumstance can require.

61. The floors of ships used commonly to extend out from the keel to one fourth the breadth on each side, and at this place the rise of the floor was usually determined. When they are nearly horizontal from the rabbet of the keel, or perpendicular to the vertical axis, the ship is said to have a flat floor, and when the flatness extends a considerable distance longitudinally, she is said to have a long floor; and as the floors rise above an horizontal line, from the rabbet, the ship is said to have a rising or sharp floor.

62. The floors have a score taken out of them at the middle (Fig. 14 and 16, *c*) to the width of the deadwood within three inches, and a score and facing taken out of the deadwood to correspond, to preserve them in their position; the depth of the score should be governed by the depth of the floor, or what is called the cutting down, the chock that is brought upon it (Note 15), and the height of the deadwood at its station, leaving at least, when the score is taken out, as much wood above it as the floor is wide or sided.

63. The difficulty and expence of providing timber suited for floors, especially in the acute parts, or where they have a great rising, which require timbers with a great bend, and frequently make it necessary to provide them out of knee timber (Note 16), have led to different methods of making them of several pieces, both by the French (Fig. 16, *xy*) and English: one of which is now in

general use in the new system of building (Fig. 16, *a b*), and may be considered of the most simple construction, and the most suited to the exigency of the times (while compass and timber of large dimensions is scarce) of any that has been introduced.

64. The made floor (Fig. 16, *a b*) is composed of three pieces, two pieces that are called half floors (Fig. 16, *d*), and one piece called a cross piece (Fig. 16, *a*), which unites them. The half floors scarph to each other, or abut with a circular coak at the middle, and the cross piece preserves their union by having circular coaks, and from two to three bolts to pass through each: but when the rising of the floor is considerable and there is a great cutting down, two cross pieces (Fig. 16, *e e*) are placed to each, and the half floors, in the room of scarphing, butt against each other (Note 25).

On the Frame.

65. The frame is that part by which the figure of the ship is given, but has no connexion in itself to preserve either its transverse or longitudinal form; it may be considered, until the other parts of the structure are united, to be a number of separate assemblages.

66. Each assemblage is called a frame or bend, and is composed of several incurvated timbers extending outwards from the keel and up to the top side (Note 26), the lower timber being united to the floors: and that the form may be given and connexion supported, each frame has two divisions with the timbers, so placed in each, that

the heads and heels (Note 27) in one division may be near the middle of the timbers in the other. The timbers in each assemblage are distinguished by floors (Fig. 14, *a*), first (*b*), second (*c*), third (*d*), and fourth futtock (*e*), and long (*f*) and short top-timber (*g*). The floors extend equally on each side of the middle (60). The first futtock abuts against the deadwood, and extends from five to seven feet above the floor-head; the second abuts on the floor-head, and extends from four to six feet above the first; the third abuts upon the first, and extends from four to six feet above the second; the fourth abuts on the second, and extends to the top of the side, excepting in two deck ships and upwards, when a short top-timber (Fig. 14, *g*) is scarphed upon them with a flat scarph, if a port timber (Note 28), about two feet above the gun deck upper sill, but if it is not a port timber, the scarph which is then a side scarph, is brought in the same line with the ports. The flat scarph is two feet in length and fastened generally with two treenails, though it is sometimes fastened with two bolts and two dowels, the side scarph is about three feet six inches, having two dowels in it and fastened with three bolts.

67. The frames are distinguished into square and cant; the square frames are to a certain extent from the middle each way, and have the plane of their sides athwartships. The cant frames are at the extremities and have the plane of their sides oblique to the plane of elevation, that they may be brought nearer at right angles to the curve of the body. These frames though oblique to the plane of elevation horizontally, have still the plane of their sides vertical or perpendicular to the keel.

The frames are likewise distinguished into frames and filling frames: every other one is a frame and the intermediate one a filling frame. The frames mostly extend from the keel to the top of the side, whereas the filling frames are frequently cut off by the ports.

68. Each frame gives the transverse form of the ship at different sections which are at equal distances, called the room and space (Note 29). To obtain the shape correctly, it is given for each at the joint or middle between the two divisions of the frame, so that the connecting edges are of the same form; therefore by the ends of the timbers in one division being placed near the middle of the timbers in the other, the form of the whole assemblage must evidently be given.

69. The frames are distinguished, those before the greatest transverse section by *letters* and those abaft by *figures*, beginning from this section which is called dead-flat, and distinguished thus ⊕: but should there be several sections of the same area, which is frequently the case in full ships, those before are called A and B, &c. flats, and those abaft 1 and 2, &c. flats, and are marked thus (1), (2), (A), (B), (Fig. 13).

70. In progressively proceeding with fixing the several parts of the frame, when the keel stem with its appendages, stern-frame, if there is one, and deadwood, are fixed in their proper positions and secured there, the floors are scored and faced upon the deadwood (Fig. 14 and 16, *c*), and set to their correct position, by making the plane of their sides at right angles to their longitudinal axis, and any

two points upon their arms (Note 30), at equal distances from the middle, made parallel to the horizon, and a piece of flexible timber, called a ribband, placed about 18 inches from their outer end, and shored to keep them firm, while the remaining part of the frame is elevated. The several futtocks are then united together in frames (70) upon the ground, by first bolting the second futtock to the first, which agrees in form from the floor to the first head; these timbers are then turned over and the third is bolted to the second, the third agreeing in form from the first to the second head; the same progressive manner is pursued until the whole of the timbers are connected into frames, and each over-launching part bolted with two or three bolts.

71. The timbers are united together at their abutments by angular connecting pieces, called chocks (Fig. 14, *i*), these pieces are fastened to each timber by one treenail and the heels of the first futtock, that is, each first futtock and its opposite by pieces called cross-chocks (Fig. 14, *k*), fastened to each timber by two treenails.

72. When the whole of the timbers are united into frames and filling frames, every frame is got up and secured in its proper position, by bolting the first futtock to the floors, and fixing the frames to their proper breadth by pieces lying horizontally across, that form a temporary security until the beams are in (6), called cross-spalls, which by their keeping the frames to the given breadth of the ship at each station, give the form of the different transverse sections; so by the cross-spalls agreeing in length so as to conform to the

ordinates of the curve, that the ship is to make in an horizontal longitudinal direction, the frames are brought by them to give the proper form.

73. The frames when up are placed in their true position by making the plane of their sides athwartships and perpendicular to the keel, and the middle of the cross-spalls which is always marked upon it, in a vertical line with the middle line of the keel. The filling frames are next got up and kept within the others by some temporary means until the frames are secured (67).

74. To secure the frames in their position, as to distance from each other, until the exterior planking is brought on, flexible pieces of fir timber, extending the length of the square body (called ribbands), and at the extremities by pieces formed to the curve of the body (called harpins), are placed one about three feet out from the keel, one about eighteen inches below the floor-head, and one in the middle between each head and keel; others are likewise placed about twelve inches below each port, and at the top breadth and top side (Note 31). When these pieces are got up and nailed to the frames with one nail in each timber, and several of them shored (Note 32) to support the ship while the different works are going on. The filling frames are then got into their true position, and the ribbands and harpings nailed to them. The plane of the sides of the cant frames and filling frames not being athwartships, the stations for fixing them are given upon the harpins.

Upon the Hawse-Pieces.

75. The space from the foremost cant frame to the knight head (Fig. 17 and 18, *c*) is filled in with timbers, called hawse-pieces (Fig. 18, *d*), these timbers have the plane of their sides nearly fore and aft, and form their abutments against the fore side of the foremost cant timber: though sometimes part of them form their abutment upon timbers (Fig. 18, *e*) left short for that purpose. In diposing these timbers, one is cut off by each hawse-hole, and is about three inches less in breadth than the size of the hawse-hole; there is frequently one placed between the foremost hole and knight-head, two between the holes; and abaft there are as many as the space requires.

76. Of late, instead of having the common hawse-pieces, the cant frames are continued to the knight-heads (Fig. 18, *x*), and take the common stepping (49), the plane of their sides gradually approaching a fore and aft line; where this is the case, there is still a single timber cut off by each hawse-hole, but with the same cant as the frames.

Upon the After Timbers.

77. At the after extremity the frames (Fig. 18) gradually cant from the after square frame to the fashion-piece (42) when there is a stern-frame. But when the ship is constructed with a round stern (Note 33) the frames and filling frames (Fig. 19 and 20) are continued aft to the timbers that are fixed on each side of the stern-post (35) called the post timbers (Fig. 19, *a*); these timbers are brought upon two fillings (*b*), six

inches in thickness, that are united to the side of the post with their after side coinciding with the rabbet (41), and extending from a chock (Fig. 19, *c*) that abuts on the stepping to the top of the side. The post timbers have projecting wood left outside to the thickness of the exterior plank, and on the inside to the thickness of the interior, from a foot below the head of the post to a foot above the upper helm-port. They are bolted through the fillings and post, the bolts passing through both timbers and fillings, and have likewise several circular coaks in them, and the fillings likewise in the post.

78. The plane of the sides of the timbers that form the round stern cant more and more from the after square frame to the post timber: such of them as form the sides of ports, that are to form lights (Fig. 19 and 20, *d*), do not continue all the way up in the same vertical plane (69), but from the lowest tier upwards, their sides tend to one point in the middle line (Fig. 19), at a certain height above the stern in afore and aft projection, (and parallel with the post timber (Fig. 20), or rabbet continued in an athwartship projection).

Upon the Rake of the Stern and Counter Timbers.

79. When the ship is not constructed with a round stern, the wing transom (41) forms the basis for the stern, and from its after edge upwards the form is determined by timbers called the counter timbers (Fig. 7, *l o*); these timbers are of oak, one of them (*l*) not only gives the rake but partakes of the form of the side, this timber is called the side counter timber, it forms an abutment upon the

wing transom and against the aft side of the fashion-piece, and it is bolted with one bolt, that passes through the fashion-pieces and the after cant frame; two or three others are placed above it, and made to pass through the short timbers (Fig. 18) which are fixed upon it to fill up the space abaft the after cant frame: these bolts should likewise extend through the after cant frame, the whole of them are fore-locked (Note 34). The side counter-timber is frequently in two lengthways; the lower piece extends as high up as it can be conveniently got, and a piece scarphed on its upper end, with a side scarph fastened with two circular coaks and three bolts.

80. The counter timbers give the form of the thwartship projection of the stern, by two curved parts and a straight, the lowest curve which springs from the aft side of the wing transom (4) and is arched upwards, is called the lower counter (Fig. 4, *z*); from the upper part of the lower counter a curvilinear angle is formed: the upper curve which is arched forward is called the upper or second counter (Fig. 4, *y*); from the upper part of the second counter the timber is straight: the angular points formed by the lower and second counter, and second counter and upper part of the timber are called the lower and upper knuckles, or knuckles of lower and upper (Fig. 4, *z y*) counter.

81. The counter timbers form the principal strength of the stern, and the midship ones (Fig. 7, *o*) are so disposed as to pass between the stern lights; if produced, they are so disposed as to meet in the same point, that is, the point where the two side counter timbers produced would meet

a vertical plane passing through the longitudinal axis. These timbers, which are sometimes called the stern timbers, have their lower ends dovetailed (Fig. 7, *r*) into the wing transom, the dovetails being in *length* the depth of the margin (40), and their ends being let in and faced upon the transom from one to two inches. But when the ship has a square or round aft tuck (46) the timbers then tenon and face into the transom. The after part of the tenon is the thickness of the counter-plank from the after edge of the transom; it is fore and aft about $\frac{1}{3}$ the breadth of the transom, and in breadth so as to be one inch within the timber on each side, and in length about four inches; the timber lets wholly into the transom one inch from the after part of the tenon to about three inches from the fore edge of the transom. The midship counter timbers have an iron strap over each of their heels on the fore side extending down the transom, and bolted through the transom and timber.

Upon the Frame in the New Principle of Building.

82. To make the difficulty less in providing, and to reduce the expence of the frame, a new mode of disposing and connecting the timbers has been resorted to in the frame, called the small timber frame (Fig. 15 and 16). In this frame the timbers are considerably shorter, and of less siding (Note 35), having two or three more futtocks introduced in each assemblage (66), and instead of having the heads and heels connected by chocks (71) (Fig. 14), they abutt square upon each other with a circular coak (Fig. 16) into their ends.

83. The difficulty of obtaining the several timbers that compose the frame arising from their

curvature and great dimensions, it is evident that by shortening them, the curvature will be made less, by taking a smaller portion of the curve contained in each transverse section, and the quantity in each timber reduced. The expence will likewise be less by the frame being made up of smaller parts, while the quantity contained in the whole frame remains constant; since timber increases in value in a greater proportion than its dimensions (Note 36).

84. In point of strength, this frame may be considered without its connexion with the other parts of the structure to be weaker than the common (Note 37), except when the forces act in the direction lengthways upon the timbers, and bring the pressure directly upon their abutments, for when the forces occasioned by the action of the weight and reaction of the fluid have a tendency to work the butts by their revolving about either edge, the coaks are not of sufficient length, nor the wood sufficiently incompressible to resist them.

85. For if we consider the weight of the guns and pressure of the fluid, &c. to be forces tending to press the side of the ship out and in alternately; as the body is inclined by the force of the wind, or in rolling, it is evident that the center of motion must be the outer or inner part of the timbers at their abutments, and the only resistance to motion is the force the coaks oppose, to describing a circular arc round the said center. If therefore the coak is short, it is evident that it will lie so much in the direction of the arc, that its resistance to motion (except it be fitted extremely tight, and the wood incompressible) will be inconsiderable.

86. In comparing the efficacy of the dowels with that of the chocks, according to the latter principle, the timber being acted upon as the one coaked, the tendency to motion on the inclined side will be round the outer part of the timber, and the resistance will be proportional to the distance of the treenail (71) from it, which is much greater than that of the coaks: it must therefore be concluded that this is the strongest method under such forces, and with such support. On the side raised out, the motion takes place round the inner part of the abutment of the chock, and there is a tendency to separate the heel of the timber from the chock at the abutment of the timbers, but this is resisted as before by the treenails.

87. The two frames have been considered exclusively of their connection with any other part of the structure. But as the exterior and interior planking, and other parts in conjunction form the principle in combining the timbers in both principles, their support must be regarded; for the frame without its connection with the other parts of the structure can only be considered as a number of separate assemblages (65), and as forming no adequate strength to the mass of materials (Note 38). In the new principle with the square butts, before a derangement can take place, the timbers must rise on the side opposite to that round which the motion takes place, but this will be opposed by the in and out fastenings, and resisted by the planks, edge to edge, throughout the structure, while the coaks prevent any lateral motion; whereas the timbers with the chocks having a tendency to work in the direction of the fastening more by the lips being thrown off, than to rise on

the opposite side to the center of motion. The timbers therefore abutting square, must give a better security to the planking, and with its fastenings no motion can take place either upon the outer or inner part of the abutments without destroying the fastenings to the timbers in conjunction; or if in working the motion takes place round any part that is firmly fixed, the coak must be destroyed before a derangement can take place, which is impossible under the common forces they are subject to.

Upon the Keelson (Fig. 9 and 10).

88. The keelson (*g*) is a timber in the interior of the ship, placed immediately over the keel, lying upon the upper part of the floors as far as they extend, and afore and abaft them upon the deadwood. It is for uniting in one mass the keel, deadwood, and floors, that a compact union may be formed throughout the system.

89. This timber is in several pieces scarphed together lengthways, formerly with a flat and hook scarph, but now, instead of a hook, the scarphs have two or more circular coaks in them, and are sufficiently long to receive two bolts in each.

90. The keelson is bolted at the floors or cross-timbers, if a made floor, as far as they extend, with one bolt in each, which passes through the deadwood and keel, and are clenched upon the under side; afore and abaft the floors, they are placed, one abaft, within six inches of the after end of the keel, passing through the lower end of the stern and inner post; and one forward, within six

inches of the fore end of the keel, passing through the thick part of the scarph of the stem: between these bolts, and those that pass through the foremost and aftermost floors, the bolts are placed at equal distances, they are upon the keelson about 18 inches apart, and upon the under side of the keel according to the space. In the upper lip of each scarph two short bolts are driven in general.

91. The keelson formerly was scored over the floors by taking the cross-chock (71) down one inch below their upper surfaces to the breadth of the keelson; but now, a circular coak is placed in each cross-chock when the floors are not made, but when made, one is placed in the half-floor. Where it lies upon the deadwood, the circular coaks are about 3 feet apart. This timber is of oak, though sometimes foreign wood is used for the purpose (Note 39).

On the Stemson (Fig. 9).

92. The stemson (*c*) is a timber at the foremost extremity inside, united to the fore end of the keelson (88), and extending upwards to the upper deck, with its fore side contiguous to the apron (28); it is for giving support to the stem and apron. This timber is scarphed to the fore end of the keelson with a flat scarph, which has two or more circular coaks in it. It is fastened with the knee of the head bolts as low down as they extend, below which the bolts are placed in it at the same distance apart as the keelson bolts; they pass through the stem, and are driven from the outside or in, as can be done with the least inconvenience, and clenched upon the opposite side.

The stemson is of oak. It has frequently several circular coaks placed in it and the apron, where they fay together.

Sternson (Fig. 9).

93. The sternson (*k*) is a timber placed at the after extremity in the interior, scarphing to the after end of the keelson, and extending up to the lower deck, with its after side where there are transoms faying against them, if none, it is brought against the inner post; it is for better preserving the union of the after timbers. This timber is scarphed to the after end of the keelson with a flat scarph having circular coaks, the same as the stemson; and it is bolted all the way up when there are no transoms, with the bolts at the same distance apart upon the inside, as the keelson, bringing one of them on the outside within six inches of the lower end of the stern-post, the others at equal distances upon the aft side to the upper bolt, which is driven nearly horizontal. If there are transoms, one bolt is driven through each.

The sternson is of oak, and sometimes has three or four circular coaks in the inner post; when there are transoms it has one coak in each.

94. When the keel and deadwood, stem, apron, and knight-heads, stern-frame, floors, and the whole of the frames with the hawse-pieces, counter-timbers and keelson, stemson and sternson, are in their place and the frame secured (65) and shored (Note 40), the ship is said to be in frame; and in this state she remains to season from six to twelve months or more. The keelson, stemson, and sternson, are frequently blocked off from

their places to allow a circulation of air to pass upon their faying surface, and upon the surface they would be in contact with; and they remain so until it becomes necessary in carrying on the different work, to remove the temporary keel, which most large ships are built upon (Note 41), and place the permanent one, for driving the bolts (90).

Upon the Planking (Fig. 21, 22, 23, 24, 25, & 26).

95. Planking (5) is the covering of the outer and inner surface of the frame (65) with strakes or breadths of plank, which extend in ranges lengthways, and terminate outside, aft, below the wing transom, in the rabbet of the stern-post (39), on the wing transom at the margin (41), and above the wing-transoms at the after edge of the side counter timber (79), and forward in the rabbet of the stem (24). Inside, it terminates aft, below the lower deck, at the fashion-piece (43), and above at the wing-transom or side counter-timber, and forward at the stemson (92).

96. The length of the ship is too great for the strakes to be obtained in one length, each strake or range is therefore composed of several, and where they meet lengthways is called the butt; the foremost and aftermost plank in each strake is called the fore and after hood (Fig. 23, 24, and 25), and the extreme ends where they abutt against the fore part of the rabbet of the stem (24) and after part of the rabbet of the stern post (39), are called the hooding ends.

(Fig. 21 and 22).

. The several lengths of plank in each strake are not always wrought with fair edges, but

sometimes with the plank formed to give strength or to aid the conversion (Note 42). When it is required for particular strength, it is worked what is called anchor-stock, that is, with one edge fair and the other with an angle in the middle of each plank where it is considerably wider, that the butts which are in one strake placed in the middle of the other may be reduced, to give strength by a smaller portion of the two strakes being cut off.

98. When it is wanted to aid the conversion of the plank, it is worked what is called top and butt, that is, with the top end of one plank one fourth the length from the butt end of the other; at this distance upon one edge, an angle is formed where the plank is left as wide as it can be conveniently got to reduce the top end of the plank in conjunction; every other seam both in anchor-stock and top and butt produces a fair edge.

99. When the edges of the strakes curve up or down they are said to *hang* or *sny*, if down to hang, and if up to sny.

100. The strakes are not parallel, but of such a breadth as the form, the places where they are situated, and the circumference of the body, at any given distances upon them, may require; narrowing at some places and widening, technically called fanning, at others, according as the body gives the form of the edges to hang or sny. The sny (99) in full ships is frequently so great as to require the foremost and aftermost planks in several of the strakes to fall short of the stem and stern-post; these planks are called steelers (Fig. 23 and 25, *a*), and most ships require one, two, or more, to bring a proper edge.

101. The principal strakes both of the exterior and interior planking are named either singly or in assemblages.

Fig. 10 and 21.

102. The principal strakes or assemblages of strakes, that compose the exterior planking in three deck ships, are the channel wale (p''), middle wale (p'''), and main wale (p''''); in two deck ships, the channel wale and main wale; in frigates and all lower classes of ships, the main wale only. All ships, except the small class brigs, have an assemblage of strakes called sheer strakes (p'). The other principal strakes which most ships have, are plank sheers (O), the black strake (a), diminishing plank (b), plank of the bottom (r), and garboard strake (c). The different strakes that come between the ports are named according as they are situated; if in the range of the gun deck ports, they are called the short plank between the gun deck ports; and so for the ports of every deck.

103. The wales and sheer strakes shew the longitudinal form of that part of the ship which is elevated above the water, by their being placed to the curve that forms what is called the sheer. Upon the degrees of curvature given to the sheer, the beauty of the form will greatly depend, so far as it affects the appearance of that part of the body subject to view.

104. The sheer given to ships of war has been lately considerably reduced. It is now made to conform to the curve of the deck or the batteries, except at the foremost extremity, where it is made

to rise about 8 inches above them, thus preserving the sheer and line of the batteries the same. This gives effect, and produces a degree of symmetry in appearance, which could only be done by painting the form before; thus the principal strakes which were before cut off by the ports, are preserved whole, by the sheer of the ship and the decks being the same.

105. In forming the sheer of ships of war, a proper disposition of the strakes with the ports is the first thing to be attended to. They ought to be placed so as to give the greatest strength, and by their form as much convenience as possible for fighting the guns; care being taken at the same time to produce a good effect as to beauty and symmetry. The sheer of ships of war ought to be as straight as circumstances will admit of, by which means the battery has an uniform and formidable appearance, and the guns can be worked with more ease and pointed with greater certainty. In other vessels, particularly pleasure vessels, a curved sheer is more suitable, since thus they are rendered apparently lighter and more lively.

Fig. 10 and 22.

106. The principal strakes of the interior planking are the strakes in the hold and the assemblages in union with the different decks: the strakes in the hold (7), are called the footwaling (*n*), and those connected with the decks, the clamps (*z*), quick-work (*u*), and spirketting (*e*), these are named according to the deck to which they are connected, as upper deck clamps, quickwork and spirketting, quarter deck, forecastle, middle deck, and gun or lower deck.

Upon Plank-sheers and Gun-wales, Fig. 21, 22, & 10.

107. The plank-sheers (5), are planks lying horizontally upon the heads of the upper extremity of the timbers, and edges of the exterior and interior planking (*s*); they form the upper boundary of the longitudinal section, and are covering planks for the top side.

Fig. 21 and 22.

108. The drift-pieces (*o'*) at the fore part of the round house (7), and at the boundary of the waist, commonly called the main and fore drifts, have their lower ends mitred into the plank sheer, and their upper ends forming a square abutment under them.

109. The plank-sheers have a rabbet taken out $1\frac{1}{2}$ inches up from the lower edge, and as much on from the outside as the thickness of the exterior planking, and on the inside as the interior; this rabbet will form in the wake of the quarter deck and forecastle the upper stop of the ports (Note 44).

110. Between the main and fore drifts, the covering planks are commonly called gun-wales, and were formerly wrought much thicker; the plank-sheers having in general the timber that formerly supported a rail, called the fife rail, let through them. These timbers formed a resistance to their rising, when caulking between them and the upper edges of the interior and exterior planking.

111. The plank-sheer and gun-wales, when not obtained in one length between the drifts, are in general scarphed with a vertical scarph, on the

quarter deck and in the waist, about three feet in length; and on the forecastle, when there is any considerable round, from 18 inches to 2 feet; these scarphs are in general bolted with from two to three bolts. On the round house (10), where the rough-tree timbers pass through them, they abutt square in in the wake of one of the timbers.

112. The plank-sheers at the quarter deck, forecastle, and round house, are sometimes fastened with nails driven into the edges of the exterior and interior planking, about two feet apart in each edge, and with bolts called tie bolts in each port timber; and at other times they are fastened only with nails into the edges of the planking, from 12 to 14 inches apart; when they let over timbers, there is one horizontal bolt driven through each timber.

113. The gun-wales are fastened with short bolts driven into the edges of the planking, from 18 to 24 inches apart, with sometimes one bolt driven through it and through the upper sill of each upper deck port, and clenched upon the underside of the sill.

EXTERIOR PLANKING.

Upon the Main Wales (Fig. 10 and 21).

114. The main wales (p'''') are an assemblage of planks placed upon the widest part of the body, and extending the whole length of the ship; they are the thickest planking, and form one of the principal longitudinal ties, as much from their situation as their substance. The fastenings of the principal deck pass through them.

115. The main wale is composed of from four to six strakes wrought anchor stock (96), or top and butt (97); if only two, they should be worked anchor stock, to give the greatest strength; if more than two, they may be wrought either way.

Upon the Channel Wale (Fig. 10 and 21).

116. The channel wale (p'') is thick strakes placed between the middle and upper deck ports in ships of three decks, and gun and upper in those of two decks (101); they receive the chain and preventer plate bolts (Note 43), and are for giving strength to the top side, or upper works (1). This assemblage is composed of three or four strakes worked top and butt, and receives the fastenings of the upper deck.

117. The lower edge of the channel wale is placed two inches, or the depth of the port stop (Note 44), above the upper part of the ports at midships, but at the extremities, if the sheer of the ship is more than the ports, it will rise the difference, which will now be only the case forward (103).

Upon the Sheer Wales (Fig. 10 and 21).

118. The sheer or middle wale (p''') is thick strakes in three deck ships placed between the the gun and middle deck ports, giving additional strength to this class of ships: they are in general wrought anchor stock, or top and butt, and the fastenings of the middle deck pass through them.

119. The disposition of the sheer wale is the same with the gun or lower deck ports, as the channel wale (117) is to the ports it is placed over.

Upon the Sheer Strakes (Fig. 10 and 21).

120. The sheer strakes (p') lie between the upper deck ports and what is called the top-timber line, or the upper boundary of that part of the side that ranges the whole length of the ship: above this line, the top side was originally formed by scrolls, worked one above the other, called drifts, to give an elegant appearance, and to prevent an abrupt termination of that part of the top side above it; but now, to shelter the crew, by presenting a more complete barrier against small shot, in the time of action, the planking and timbers are continued up a sufficient height to form a barricading to the quarter-deck and forecastle. This assemblage was formerly in two strakes, and was the principal longitudinal tie to the upper part of the top side, for which reason the several lengths were scarphed together, between the drifts, with a hook scarph, bolted up and down with two or three bolts, but they are now wrought in as many strakes as the breadth between the ports and under side of the plank-sheer (110) in midships may require; if three strakes, the two upper may be worked anchor stock, or top and butt, and lower one fair edged; but when appearance is studied, the whole of the edges should be worked fair.

121. The lower edge of the sheer strakes is the same in relation to the upper deck ports, as the middle and channel wales are to the ports they are placed over (117 and 119).

122. The sheer strakes in such classes of flush deck vessels as have them, should always be scarphed (120), as they form a principal tie to the top side.

Upon the Black Strake (Fig. 10 and 21).

123. The black strake (*a*) is the strake lying upon the upper edge of the main wales, for graduating between the thickness of the plank of the top side, immediately above it, and these strakes; formerly the black colouring of the lower part of the upper works was terminated by its upper edge.

124. This strake is of a parallel breadth, and works up, in two and three deck ships, to the depth (Note 44) of the stop below the lower port sill.

On the Diminishing Plank (Fig. 10).

125. The diminishing plank (*b*) is the planking immediately below the main wales, for graduating the difference of the thickness between the plank of the bottom and main wale; this planking is in general composed of from two to six strakes, or a sufficient number to prevent, by their diminishing too fast, their forming an angle with the plank of the bottom.

126. The diminishing plank is in general worked anchor stock or top and butt, but mostly top and butt, to aid the conversion.

Plank of the Bottom (Fig. 10).

127. The plank of the bottom (*r*) may be considered as the planking from the main wales to

the keel, or the whole of the exterior planking (5) which, by its being water-tight, causes the ship to float; but here it is only reckoned from the lower part of the diminishing plank to the keel, or the whole of the planking below the main wales that is of equal thickness.

128. The plank of the bottom is wrought top and butt to some distance beneath the light water line, or as low as the English oak is worked, below which, Dantzic plank or plank of the same quality is used, as they are better preserved under water, and this species of plank being nearer of a parallel breadth, the strakes are wrought fair edged. Sometimes several strakes out from the keel are of elm, as a suitable place to use this kind of plank, and it is not so soon injured by rubbing, in the event of the ship's taking the ground; these strakes are likewise wrought with a fair edge.

On the Garboard Strake, Fig. 10.

129. The garboard strake (*c*) is the lower strake of the plank of the bottom, with its lower edge formed in a rabbet taken out of the upper edge of the keel (22).

130. This strake is in general of elm, and worked fair edged.

Upon the Circular Coaks used in the Strakes.

131. To prevent an extension in the way of the butts of the sheer strakes, channel, middle and main wales, black strake, and four upper strakes of diminishing plank, they are coaked to the timbers,

INTERIOR PLANKING.

Upon the Footwaling (Fig. 10.)

132. The footwaling (*n*), sometimes called cieling, is the interior planking below the orlop clamps (105), immediately opposite to the plank of the bottom, for giving strength to the frame (65) and preventing the ballast, &c. from getting into the openings between the timbers. It is composed of several assemblages of thick strakes, and others of diminished but equal thicknesses; two, of thick strakes are wrought over the abutments of the timbers, called the thick strakes upon the floor (*h*) and first futtock (*k*) heads; one, near the keelson, called the limber strakes (*l*), and one under the orlop clamps, called the thick strakes under the orlop clamps (*f*). The strakes of diminished but of equal thickness are distinguished into the strakes between the limber and thick strakes upon the floor head, and those between the thick strakes upon the floor and first futtock heads.

133. The footwaling is of oak planking, in general the refuse of the other planking through its being shaken (Note 45), or otherwise defective, but not in a state of decay. It is wrought top and butt with its joints quite close, to prevent the filth, if possible, from getting between the timbers.

134. The whole of the footwaling, except the limber strake, is now left out, below the thick strakes under the orlop clamps (13).

Upon the Limber Strake (Fig. 10).

135. The limber strake (l) is a strake placed on each side the keelson, for forming a water course from the extremities of the ship to the pump well. Formerly there were two strakes of equal thickness wrought top and butt, and sometimes one of less thickness without them; but these three strakes were in general reduced to one forward and aft.

136. The limber strake is placed, in the full part of the ship, 11 inches from the side of the keelson, and at the termination of the water course, 5 inches. The water course continues as far towards the extremities as the acuteness of the body may require, and beyond its termination, or where the limber strake is worked against the keelson, limbers are formed by taking off the lower angle of the midship edge of the strake.

137. This strake has its midship edge worked parallel to the side of the keelson to the distance of the water course, and a rabbet taken out to 3 inches down and about $1\frac{1}{2}$ inch on, to receive boards called limber boards (g'), for forming the upper part of the water course or limber passage. The limber boards are made of oak plank from 3 inches to $3\frac{1}{2}$ inches in thickness, and fitted with one edge or end in the rabbet taken out of the limber strake, and the other against the keelson, with their upper surface lying with a descent from the upper part of the keelson to the upper part of the limber strake. They are worked with the grain or range of fibre up and down under the hatchways and fore and aft, in lengths of about 3 feet in all other parts.

138. The limber strake is now worked without any other strake in union, and has one circular coak in each cross chock (71) when the first futtocks (66) run down; but when the floors are made (64), the circular coaks are placed in the half floors.

Upon the Thick Strakes on the Floorheads (Fig. 10).

139. The thick strakes upon the floorhead (*h*) are strakes wrought to give support to the abutments of the second futtocks and floors (66); these strakes are in number according to the rate of the ship. Ships of the line have two thick strakes worked over the abutments, and two above and below of diminished thickness; the whole of them wrought top and butt, and diminished to four strakes at the extremities. Large class frigates frequently have the same, while those of the middling class have in general but one strake worked over the abutment, and two above and below, wrought top and butt, and reduced at the extremities to three: and the smallest class have but three strakes in the whole, one over the abutment and one above and one below, and reduced to two. Smaller vessels have but two worked top and butt over the joint, and reduced to one at the extremities.

140. These strakes are likewise reduced about one-third in thickness at the fashion-piece and apron, continuing their whole thickness within from eight to ten feet of these timbers.

Upon the Thick Strakes on First Futtockheads (Fig. 10.)

141. The thick strakes upon the first futtockheads (*k*) are for supporting the abutments of the

first and third futtocks (66). They are placed immediately over what is commonly called the joint of these timbers. Ships of the line and large frigates have two thick strakes over the abutments or joints, worked top and butt, and one above and below of diminished thickness, and reduced to three at the extremities; smaller ships have three, and reduced to two. The whole of these strakes are reduced to two-thirds the thickness of the thickest strakes at the apron (28) and fashion-pieces (43), but continue their whole thickness within from 8 to 10 feet of these timbers.

Upon the Clamps (Fig. 10 and 22).

142. The clamps are ranges of thick planks extending the whole length on the interior of the frame, for supporting the ends of the beams of the different decks; they are in one or more strakes, according to the deck they are connected with.

(Fig. 10.)

143. The orlop clamps (z'''') are in two strakes, wrought top and butt; the lower strake was formerly one inch less in thickness than the upper, but is now of the same thickness. The two strakes were reduced to one formerly, at each extremity, but now only forward. The lower one should be worked into the upper, with an abutment of about four inches (or what is technically called being worked in with a steeler), if for strength; but for taking out the sny, the upper should be worked into the lower. These strakes are likewise reduced in thickness at the extremities to two-thirds the thickness of the thickest strake, or to make the

whole of the planking at these places without projection, but maintaining their whole thickness within eight or ten feet of the ends.

(Fig. 10).

144. Below the orlop clamps, in ships of the line, two strakes (f) are wrought top and butt, the upper one from one to two inches less than the clamps, and the lower one to the thickness of the plank of the bottom; these strakes are reduced to one forward, and made to an even surface at each extremity. Smaller class ships have only one strake below the clamps, equal to the thickness of the plank of the bottom.

(Fig. 10).

145. The lower deck clamps (z''') were formerly in two, three, or four strakes, according to the class of ships; two and three deck ships had three, though sometimes the larger class of two deck ships had four, but more commonly three, and frigates two. When in four and two strakes, they were wrought top and butt, and their edges sometimes tabled into each other with an $1\frac{3}{4}$ tabling (Note 46). When in three, two were wrought top and butt, either tabled or plain, and the single strake was either placed above or below them; when placed above, it was scarphed with a hook and butt scarph, from 3 feet 6 inches to 4 feet in length. The number of strakes was always reduced to one less at the extremities, and reduced in thickness as described for the orlop clamps.

146. These clamps are now worked in two

strakes wrought top and butt, with both strakes ranging the whole length.

147. Below the lower deck clamp are worked two thick strakes (f), wrought top and butt, about three fourths the thickness of the clamps, and upon the end of the orlop beams is one, an inch less than the clamps, with its lower edge scored over the beams, and let down one inch below their upper surface; and frequently upon this, one of the same thickness as the strakes under the clamps, which the distance between the orlop and lower deck beams will determine, as there must always be left for air, an opening of about four inches, either above the upper edge of the thick strake upon the orlop beams, or the strake above it.

148. The lower deck of corvettes and orlop of frigates have no clamps, but the shelves (5) work home to the timbers.

(Fig. 10.)

149. The upper and middle deck clamps (z'' and z''') are worked in one strake down to the ports; they were scarphed formerly with a hook and butt scarph, about 4 feet six inches in length; but now, instead of a hook, the scarph has two circular coaks placed in it, about one-fourth of its length each way from the lips; the lips are always brought upon the timbers, and have one up and down bolt in each, placed abreast the opening between the timbers nearest the lips.

150. These clamps are always reduced in thickness at their lower edges, called bearded, formerly

they were reduced one-fifth, commencing at the middle of their depth down, where they maintain the whole substance, but now one-tenth, commencing from the lower side of the shelf (5). The clamps used to be left, the whole substance, in the wake of the center of the ports, to receive the muzzle of the guns when housed, but now they are bearded quite through.

151. The upper deck clamps of frigates and all single deck ships are in two strakes, wrought top and butt, and range the whole length of the ship, as explained for the lower deck clamps (145).

(Fig. 10.)

152. The quarter deck and forecastle clamps (z') are in two strakes, wrought in general anchor stock, sometimes with one edge worked into the other with a hook. The lower edge is worked down to the upper deck ports, and bearded (150) half an inch, formerly from half their depth down, but now, from the under side of the shelf.

153. In the waist, or to that part of these strakes which was commonly called the string, additional security used to be given, by placing one bolt in each timber, to pass through them and the sheer strakes (120), driven from the outside and clenched upon the inside; and in the room of having square butts, they were scarphed with a hook and butt scarph, with the scarphs placed between the ports and the scarphs of the sheer strakes. They used likewise here to work up to the gunwale, which was wrought over their edge. To form clamps for the beams that came in the waist, a strake was worked upon them, which extended at least six feet abaft

the foremost beam of the quarter deck and before the after beam of the forecastle; this strake was fastened with bolts about 18 inches apart, driven from the outside and clenched upon the inside; but now the clamps continue the same through the waist, as the great support which has lately been given to this part renders any additional strength with the clamps unnecessary.

(Fig. 22.)

154. The round-house clamps are in one strake, worked down to the quarter deck ports with their lower edge bearded, formerly one fourth their thickness, and to half their depth, but now to one eighth and to the under side of the shelf.

155. Before the shelf and other modes of security were introduced, these clamps had an additional bolt under each beam, and one or two between, driven from the outside and clenched upon them.

156. The whole of the clamps are in general worked with their lower edges square to the timbers, and the upper edge level, and of such an height that the beams may let into them at least $\frac{3}{4}$ of an inch; but when the body falls out they must be placed high enough for the beams to have a bearing on the inner part of their upper edge.

157. The clamps are coaked to the timbers; when more than one strake, a circular coak is placed in the strake above and below the butt in the timbers, on each side those upon which the butt is situated; and when but one strake if scarphed,

a coak is placed in each timber next to that upon which the lip is placed, and if with a square butt, they are placed next to the butt timber.

158. That the strakes in each assemblage of clamps may be brought to act in union in resisting extension, they are bolted together with up and down bolts; one is placed opposite the opening between the timbers, on each side of the timbers upon which the several butts are situated, and one opposite to about every third or fourth opening, according to the distance between the butts; these bolts are in general clenched upon the upper or lower edge, according to the way in which they can be most conveniently driven.

Upon the Spirketting (Fig. 10 and 22).

159. The spirketting (*e*) is composed of thick strakes lying immediately above the waterways; when there are ports, they fill up the space from the waterway to the port-sill. This assemblage is in general composed of two strakes worked anchor-stock, with the middle of each plank as wide as possible, for giving strength in the wake of the butts; formerly their edges were worked with a hook between each butt.

160. The outer part of the upper edge of these strakes is made in a line with the port-sill, therefore if the timbers fall in from a vertical line, as the upper edge is worked perpendicular to them, and the sills lie horizontal, the inner part of the upper edge must be placed as much above the sill as the timbers incline inwards in the thickness of the plank, when the inner part of the upper edge is taken away fair with the sills in the wake of the ports.

161. The spirketting has one bolt passing through it, driven from the outside, and clenched, in each butt, through the timber next to the one upon which the butt is placed; and has likewise two through each port sill.

Upon the Quick-Work (Fig. 10 and 22).

162. The quick-work (u) is the planking lying between the clamps and spirketting; formerly, when the planking above the sheer strakes was ornamented with trophies, it was likewise called the quick work.

163. When this planking comes between the ports, it is worked with fair edges; in other places, as on the lower deck of frigates, it is in general worked top and butt.

164. To give longitudinal support, there are now between the ports, instead of quick-work, trusses (Note 47) forming their abutments against the clamps, spirketting, and abutment pieces, which are firmly fixed to the port timbers for that purpose.

(Fig. 22).

165. The abutment pieces (w') have one edge coinciding with the port, and are in breadth, to the gun deck ports 13 inches, and to the middle and upper deck 12 inches; they extend from the clamps to the spirketting, with their ends let into them, as far up into the clamp and down into the spirketting as the moulding that is stuck upon the edges of these planks: but before they are let down into the spirketting, a score is taken out of their lower ends of $1\frac{1}{4}$ inch on the port side of each abutment piece for the port cants.

166. These pieces are bolted at their upper parts with two in-and-out bolts, and about 3 inches from each end, with one fore-and-aft bolt; the other fastenings consist of the ring and eye bolts to the ports, and the treenails that come through above them. To aid in resisting any action that may be brought upon them by the trusses, they are coaked to the port-timbers with one coak opposite to the end of each truss.

Fig. 22.

167. The truss-pieces (u'') have their ends that tend towards the extremities elevated to an angle equal to the diagonal of the figure formed by the clamps, spirketting, and abutment pieces (Note 48). The lower end forms an equal abutment against the spirketting, and one abutment piece and the end elevated, against the clamp and the other; they are in breadth 11 inches to the gun-deck ports, and 10 inches to the middle and upper deck, and in thickness $\frac{1}{2}$ inch less than the abutment pieces.

168. When the ends of the trusses come opposite to the openings by the abutment pieces exceeding the breadth of the port timbers, a small sill of about an inch in thickness and of a breadth sufficient to take the ends, is let into the timbers across the opening to form a stop for the oakum, when their ends are caulked.

169. In two spaces between the ports in midships, instead of a single truss there are cross trusses placed (u'''). The whole of the trusses are fastened by the treenails that pass through the side.

Upon the String (Fig. 22).

170. The string (z') is strakes, inside, immediately opposite to the sheer strakes (120). In ships with a quarter deck and forecastle (10), it is only that part of the clamps lying in the waist (153); but in flush decked ships it extends the whole length and is in one strake, scarphed with a hook and butt scarph, or as described for the middle and upper deck clamps (149), worked down to the ports and up to the under side of the planksheer.

171. The string, when in more than one strake, is coaked and fastened as the clamps to which it is connected, and in flush deck vessels when in one strake, one bolt and one circular coak is placed in each port timber (Note 49), and one or two bolts between the ports; the bolts are driven from the outside through the sheer strakes and clenched upon the string. The circular coaks to aid the scarphs are placed the same as described for the clamps of a single strake (157); and the scarphs are from two feet six inches to three feet in length, so as to bring the lips upon timbers; they are placed between the ports as far from the scarphs of the sheer strakes as possible.

PLANKING GENERALLY.

Upon the placing of the Butts.

172. The butts are properly placed, or what is technically called properly shifted, when they are suitably disposed in relation to the ports and to each other; and when the butts of the exterior and interior planking are the farthest separated.

173. In placing the butts in relation to the ports, the best disposition is obtained, when the butts are placed in the middle between them, but this can only take place with the two strakes that come next, either above or below the ports, as the butts of the third must come under the port, or the distance of the butts of the other strakes from the ports must be less, which would not give so good a shift, excepting where there are row ports; it may then require to place the butts nearer the ports to obtain a good shift. When the planks overrun two ports to the middle between the other, it is called a two port shift, and it will require planks from 19 to 23 feet; and when three ports, it is called a three port shift, and will require the planks from 29 to 33 feet in length; both these shifts should be introduced, as in general, the more the lengths are varied within certain limits, the greater is the certainty of making the least possible consumption of plank. The first butt is always placed where the pump-dale scupper will pass through, as this scupper will cut off one strake.

174. When the butts are properly placed in relation to each other, they are apart, or have a scarph of $\frac{1}{4}$ the length of the planks under 24 feet; but when above, if the length of the planks, the butt of a timber, or any circumstance occasioned by any of the timbers of the frame require it, the length of the scarph can be reduced to six feet. There are always three planks between every two butts, and the butts are placed not to form steps or follow with the length of the scarph in regular succession from each other, but the butts in the second strake are placed in the middle of the planks of the first, the butts of the third the length of the scarph

beyond the butts of the second, the fourth double the length of the scarph beyond the butts of the third, and the fifth with the butts under the butts of the first. The fore and after hoods (96) are never less than six feet.

Upon the Projections left to the Exterior Planking.

175. Formerly there were projections left from one inch to $1\frac{1}{2}$ inches on the upper and lower edges of the sheer strakes, sheer, channel, and main wales, and upper part of the black strake; but now projections are only left at the upper part of the main wale and black strake, and at the lower edge of the sheer strake, sheer, and channel wales.

Upon the Fastening of the Planking.

176. The fastening that connects the planking to the frame (65) of the ship is distinguished by treenail and metal (Note 50); treenail when the fastenings consist chiefly of treenails, and metal when the planking is fastened wholly with copper or iron bolts, screws, or nails.

177. When the planking is treenail fastened, the strakes are either double, double and single, or single fastened; that is, so as to have in each strake, when double, two treenails in every timber; when double and single, to have two in every other timber, and one in the intermediate; and when single, to have only one in each timber.

178. Formerly, large frigates and all upwards were double fastened, and smaller ships double and single from the black strake (123)

down. Above, the large ships were double and single, and the smaller ships single; though sometimes when the timbers were of little scantling, the smallest class of vessels were single fastened only, and the larger class double fastened throughout. Now all ships when they have thick waterways (12) and a shelf (8), have the strakes single fastened in their wake, as the bolts that pass through them become fastening for the planks, and frequently, with this number of treenails, more than required; through which the timbers of the frame and planking become unnecessarily injured (Note 51). When the cieling (132) is left out (134), the strakes of the bottom (127) are single fastened below the thick strakes under the orlop clamps (144), as the bolts in the trussed frame (16) add considerably to the fastenings. And when the ship is built with the small timber frame (82), the planking throughout is likewise only single fastened.

179. The treenails that fasten the exterior planking pass likewise through, and form the principal fastening of the interior, but as the exterior and interior planking cannot be placed on the timbers at the same time, the exterior is brought on first, and the holes for the treenails bored through it and the timbers, but to secure it to the frame till the treenails can be driven through both: there were formerly one bolt placed in every fourth timber in each strake, called hanging or fastening bolts; but now the outside planking is held to the frame by a temporary fastening, consisting of screw eye bolts; these bolts are in length, from a shoulder left just beyond the eye, about $1\frac{1}{2}$ the thickness of the plank, and have a worm cut on from their ends about six inches. When the planking is properly

placed upon the timbers, or what is technically called set to, or well timbered, the holes are bored through, to the size of the screw bolts, at the stations of the treenails, and at such places as is necessary to bring or keep the plank to; and to prevent the shoulder of the bolt making an indent in the plank, an iron plate is put behind it, to receive the pressure. When the interior planking is brought on, the holes for the treenails are bored through it, and the screw bolts are removed as it becomes necessary to drive the treenails. If after the treenails are driven, and the whole of the fastenings of the internal works, it is found there is not sufficient security in the planking, then other bolts are added; if to the outside planking, the bolts pass all through from the outside, and are clenched; and if for the inside planking, in the thick strakes, short bolts, called short bolts, are driven $\frac{3}{4}$ through the timbers; but if the planking is thin, nails are then used instead of bolts.

(Fig. 23).

180. To fasten the butts, the butts were formerly brought upon the middle of the timber upon which they were placed, and had one treenail and one short bolt in the butt of each plank in the butt timber, and one through bolt, called the butt end bolt, in the timber next the butt; this bolt had a ring under the head, or what is technically called, was driven upon a ring, and was clenched on the inside; but now the butt is brought about two inches from one edge of the timber, and has one treenail and the butt end bolt, in the butt timber, in the plank that is farthest on it; and one treenail and the butt end bolt in the timber next the butt, in the plank that is the least upon the butt timber.

The hooding ends forward (Fig. 23, x) have a bolt driven about five inches, and a treenail about ten inches from the rabbet of the stem. Aft, (Fig. 24 and 25) where the planks fan (100) and butt against the rabbet of the post, there is one bolt, and one treenail in each butt; and as high up as the acuteness of the body will allow, the bolts and treenails pass through, and are fastening to the planks on both sides. Where they come upon the transom and butt against the tuck-rail (Fig. 24, a), there is sometimes one bolt and one treenail in each, and at other times two bolts in each butt, which is far the best, as treenails are bad fastening near the butt.

181. The treenails have both their ends caulked, to form a resistance to separation in the direction of their length. The large treenails are caulked four ways, as □, the middling three ways, as △, and the small twice, as ⊕. In the garboard strake (129) and one or two strakes above, according to the form of the body, the treenails do not pass through, but are driven about three times the thickness of the plank into the timber. In the transoms the holes are bored through, but sometimes the treenails are driven short. This should not be the case; for if the hole is left, there is a receptacle for substances that soon create decay.

Upon Metal Fastening.

182. Metal fastening either consists of copper or iron. Copper is used below water, and to about two feet above its surface, and at the bows all the way up; and iron in the remaining part of

the upper works. Formerly ships were fastened with iron throughout; but this species of fastening, after the bottoms of the ships were coppered, was soon destroyed, and though every pains was taken to prevent the communication of the two metals, still oxidation took place very fast when combined with the salt water, and the iron being the less pure of the two metals, was soon destroyed. (Note 52).

183. Ships seldom have their planking entirely fastened with metal; when it is the case, then only ships built of fir and a small class of vessels; each strake is then fastened either double, or double and single, with dump bolts or nails, with one through bolt placed in about every fourth timber, instead of the nail or dump bolt, driven on a ring and clenched. The butts of the planking, in metal fastened ships, are secured the same as those with treenails, excepting that there is a nail or dump bolt in the butt, instead of the treenail.

184. Treenail fastening will better resist any transverse strain than metal, according to the present proportion of the diameter of the bolts with the treenails; but the metal will better resist the direct strain or separation; therefore if the treenails are used in numbers, as the bolts are in treenail fastened ships, and bolts or screws the same as treenails, there is no doubt of increased strength and greater durability; for since the resistance to separation is the same, but the fibres cut off by the fastening less, the strength must be increased, and the greater the number of joints of wood and wood, not in close contact, the greater the exposure to decay.

Upon the Beams (Fig. 10).

185. The beams (*s*) are horizontal timbers extending across the ship, for uniting the two sides and for supporting the different batteries, called decks and other platforms (9). These timbers rest at each end upon the clamps, (142), and in the middle upon pillars (11); they are disposed on the principal decks in general, one under each port and one between, excepting in the places of the hatchways, masts, and mizen step, where this order is not exactly observed, but deviated from as little as possible, that they may give the best support to the guns (Note 53).

186. Abaft the mizen mast the beams of the middle deck in three deck ships, and upper deck in ships of other classes, are placed at equal distances and nearer together; as they cannot have pillars under them on account of the tiller. The beams likewise of the round house, quarter deck, and in three deck ships, the upper deck, are placed in a similar manner, to preserve uniformity, and to present no obstruction in the accommodation, by having pillars under them in the officers' apartments.

Fig. 25.

187. The beams are distinguished into single pieces (*a*), two (*b*), three (*c*), and sometimes four piece beams (*f* and *g*): the length of the beams and the timbers that can be provided to make them will determine the number of pieces they are to be composed of, which should always be as few as possible; for the quantity of timbers required to

make them will be increased with the number of pieces, because the number of scarphs is increased (Note 54).

188. When a beam is made or composed of more than one piece, the pieces are united together with vertical scarphs. If in two pieces (*b*), the scarph is $\frac{1}{3}$, if in three pieces (*c*), $\frac{1}{4}$, and when in four pieces (*d* and *g*), $\frac{1}{5}$ the length of the beam (Note 54).

189. The scarphs are distinguished into right and left hand scarphs, and are named by the hand that is on the side of the angle, or the side from which the wood to form the scarph is taken off; when at the side end, the face is towards the scarph and looking upon the upper surface; they are bolted (*x*) with from seven to nine bolts, so as to make their distances apart from 16 to 18 inches, placed alternately, about $2\frac{1}{2}$ to $3\frac{1}{2}$ inches from the upper and lower part of the beams. An equal number of them is driven from each lip side and clenched upon the opposite; in addition to these bolts, one nail is driven into each lip on the opposite edge to the nearest bolt, and one bolt is frequently driven up and down in each lip to prevent its splitting.

190. The lips of the scarphs are in thickness to beams from 7 to 9 inches sided, $2\frac{1}{2}$ inches, from 9 to 12, three inches, from 12 to 14, three inches and half, and from 14 inches sided upwards, four inches thick. The lips of fir beams are $\frac{1}{4}$ of an inch thicker. The breast beam of the quarter deck and forecastle, if in two pieces, has the lips of the scarphs let in flush, and the beams are sided the

thickness of the lip more than the common siding; but if a three piece beam, the side of the beam that has the lips flush, is placed towards the waist, and if the two end pieces are short of each other, a piece is let in the thickness of the lips between them, so as to make the side of the beam fair.

191. When the beams form the side of the hatchways or ladderways, if a two piece beam, the lip is made to go beyond the hatchway; but if a three piece beam, they are placed so that the fair side of the beam may be to the hatchway.

192. In each scarph (*m*) there are as many circular coaks within one, as bolts placed upon alternate edges, about the same distance from the edge as the bolts; formerly they were spaced for the bolts to pass through them, but now between the bolts.

Upon uniting the two Sides.

193. The two sides are preserved at their proper distance from each other by the beams (185), which are firmly combined to them (9), by different methods, according to the idea of the ship builder at different periods, or according to the necessity of the times.

194. To make the most effectual combination of the beams to the sides of the ship is of the first consequence, both as it regards the safety of the ship and the comfort of the crew, since upon this security the transverse strength chiefly depends; for it has to sustain the whole force and working of the side, when acted upon by the weight of the guns,

stress of the mast under a press of sail, and pressure of the fluid when the ship is inclined by the force of the wind, or when rolling.

195. The stresses that act upon the side of the ship have a tendency principally to separate the side from the beams, and to cause successive variation of the angle formed, transversely, by the side of the ship and the beams, which produces the working.

196. To give the best disposition to the fastenings that form the combination of the side to the beams, so as to oppose the greatest resistance to separation, they must be placed as much in a line with the beams as practicable, for they will be acted upon by a greater force, in degrees proportionate to the distance they are above or below them.

197. To prevent working, such modes of security should be applied, that while they oppose the change of form, they may resist when motion takes place, the alteration bringing a transverse action on the fastenings, which soon destroys the compactness of the connexion.

198. The methods of security should be such, that the beam ends may be easily replaced, if injured by shot or premature decay.

(Fig. 26).

199. The mode of securing the beams to the side in general use formerly, was by lodging and hanging knees (Note 55), when one of each

was placed to every beam end. The hanging knee (*a*) was secured to the side of the beam, and to the side of the ship, with the plane of its side vertical, or in the same plane with the side of the beam. The lodging knee (*b*) was secured to the opposite side of the beam, lying horizontally, or with its upper surface in the same surface with the upper part of the beams, and lodging upon the clamps (142).

200. The arms of the knees secured to the ship's side were called the side arms, and those to the beams, the beam arms. The side arm of the hanging knee, which was fayed to the inside of the interior planking, was likewise called the hanging arm; and the side arm of the lodging knee, which was fayed to the timbers, the fore and aft arm.

201. The athwartship arm of the hanging knee extends out from the side of the ship, from three to five feet; and the hanging arm down from the upper part of the beam to about nine inches below the upper part of the spirketting. The lodging knee is brought against the aft side of the beam in the fore body, and fore side in the after body (Note 56). The athwartship arm extends from the side, so that the toe (Note 57) may be nearly in the same fore and aft line with the toe of the hanging knee. The fore and aft arm extends the whole distance between the beams, when practicable; but always a sufficient distance from the beam to receive from three to four bolts.

202. The upper part of the beam arm of the hanging knee is always below, at the outer part, the upper surface of the beam, an inch or $1\frac{1}{2}$ inches,

that when the variation of angle, or working takes place, the toe of the knee may not act against the under side of the flat of the deck.

(Fig. 27).

203. When the beams come over a port, so that the plane of the side of the knee cannot be in the same plane with the side of the beam, without lying before it, the knee is brought with the plane of its side diagonally from the beam, when it is called a dagger knee (*a*), or formed with a curve to clear the port, when it is called a cast knee (*b*).

204. The orlop and platform beams are secured with a lodging and standard knee, the latter of which is similar to a hanging knee inverted. The standard knee extends from the under side of the beam to which it is connected, to about three inches below the lower side of the beams of the deck above. When a rider (15) passes up by the side of a beam, the standard knee is omitted.

205. When on account of the direction of the edges of the interior planking, or what is technically called the flight, crossing the direction in which the surface of the deck cuts the side, the beams then, instead of being brought against the timbers of the frame (65), and lying upon the clamps (142), form their abutment against the plank, which is the case at the after and sometimes the fore port of the orlop, and after port of the lower deck; the lodging knees will then have their side arm against the planking.

Upon the Fastening of the Knees.

206. The bolts that fasten the knees are distinguished into in-and-out and fore-and-aft; the in-and-out are those that connect them to the side, and the fore-and-aft to the beam. The in-and-out bolts in the hanging knees are from five to seven in number; the lower one is in general placed in the upper strake of spirketting, the upper one on a level with the under side of the beam, or as high up as practicable, and about one-fourth the breadth of the knee from the edge nearest the beam; this bolt stives upwards as much as possible, so as to come below the upper part of the knee, at the side; the second bolt is five inches below the upper one, and at an equal distance from the opposite edge; the third is about nine inches below the second; the others are placed at equal distances between the third and lower one, and upon alternate edges. The whole of the bolts below the upper one take their shortest distance through the side.

207. The in-and-out bolts in the lodging knees are never less than one in each timber, nor less than four. One bolt passes into the beam and through the timber behind the beam end, and one bolt about five inches from it, which passes through the nearest edge of the timber next the beam. The other bolts are placed as nearly at equal distances as the timber will allow, and the whole are placed upon alternate edges, at about one-fourth the depth or siding of the knee from the edge. When the lodging knee extends the whole distance between the beams, the upper bolt of the hanging knee passes through it.

208. The in-and-out bolts are driven from the outside, and clenched upon the knees, excepting that frequently one bolt in each knee, to draw it to the side, is driven from the inside and clenched upon the outside.

209. The fore and aft fastening consists of from three to five bolts, which unite the knees to the beam, by passing through both and the beam. They are driven from the hanging and lodging knee sides alternately, and the two bolts next the toe are clenched.

210. The in-and-out fastenings are driven before the fore-and-aft, that the knee may be brought firm against the side.

211. When the riders (12) take the places of the standard knees, two of the fore-and-aft bolts that pass through the lodging knee are then driven through the rider.

212. To aid the fore-and-aft bolts in resisting the separation of the side from the beams, or to take the transverse action of the bolts, two circular coaks are placed in the lodging knee and beam, and two in the hanging knee and beam, in the firmest wood between the bolts.

213. The principle of security, with the lodging and hanging knees, was in general use for a long time, and the first alteration from the former method was owing to necessity, through the great want of knee timber, and not from any proof of the inefficiency; though it was evident the association

was not complete, as only part of the fastenings could be of any considerable use in resisting a separation or opening. Nor was there any considerable degree of firmness in the combination, as frequently the bolts near the toe of the hanging knee were broken off, and when the ship was labouring in a sea, the first seam on the flat of the deck would open considerably.

Upon the new Mode of uniting the two Sides.

214. The plans now in general use for uniting the beams to the side are formed by the combination of wood and iron; wood to give the support when motion takes place, and iron to form the tie, this being considered the best disposition for such materials; for if the iron had entirely to receive the pressure or give support, it would evidently be made weaker at every motion (197) because the elasticity of this metal is so inconsiderable, that it would have little tendency, when bent, to rerecover its figure; every change would therefore reduce its tenacity; or if the wood had to form the tie, the substance required to give equal strength with the iron would be so great, that its contraction or shrinking would soon render it useless, by the combination losing the firmness required.

Upon uniting the Beams to the Side with Chocks and Plate Knees.

215. The plan first introduced, of any consideration, as a substitute for the hanging and lodging knees, was the chock and plate knees. This plan had a chock under the beam, bolted through

the side, to receive the stress, and a plate knee fixed on each side of the chock and beam, immediately opposite to each other, to form the union between the chock, beam, and side.

Upon the Chocks (Fig. 28 and 29).

216. The chocks (*b*) are the same breadth as the beams at the upper part and tapered to the lower part, where they are from two to four inches less; they form an abutment under the beams, and extend down *to the orlop beams,* about four feet six inches, and scarf on the head of the rider (12), if there is one under the beam; *to the gun deck,* they extend to about six inches below the upper part of the thick strakes over the orlop beams (147), (sometimes to this deck they have been nearly of a parallel breadth, and their lower ends have formed an abutment on the orlop beams); *to the upper deck* they extend, generally, from six to eight inches below the gun-deck spirketting; *and to the quarter deck, forecastle, and round-house beams,* they form their abutments on the spirketting of the decks below. Above the spirketting and thick strakes over the orlop beams, the strakes should be carried back to the breadth of the chock, from an inch to $1\frac{1}{2}$ inches, to give a firmer abutment to the lower end of the chock, so as to receive the stress, and take the action of the bolts. Under the orlop beams the chock (*m*) in general scarphs on the upper part of a rider, if there is one under the beam.

217. Formerly the upper end of the chock had a tenon in the under side of the beam, but now

the beams form a hook upon the ends of the chocks, against which wedge-like keys are driven, with a view to bring the beam and side in close contact. The keys are of iron, and in general driven in a copper case, to prevent the wood from yielding too much by the compression.

218. The chocks are of oak, and project from the interior planking at the upper part, sufficiently to receive the plate knee; or to the orlop and gun deck, about two feet two inches; the upper and middle decks, one foot eleven inches; quarter deck and forecastle, one foot five inches; and to the round house, about one foot two inches; at the lower part they are from three to six inches, and have their ends rounded off.

Upon bolting the Chocks.

219. The chocks are in general bolted with six bolts; the two upper are placed abreast of each other, from five to seven inches below the under side of the beam, or as high up as is practicable. They are driven in general from the inside, and clenched on the outside, to draw the chock to the interior planking. The next bolt is from eight to ten inches below the upper. The lower bolt, when the side falls home to the middle and upper deck, is frequently in the spirketting to the gun deck; it is placed about four inches above the thick strakes over the orlop beams; and to the other decks, about four inches above the spirketting: the remaining bolts are placed between these at equal distances, and upon alternate edges, about $\frac{1}{4}$ the breadth of the chock from the edge. They are

driven from the outside and clenched upon the chock.

Upon the Circular Coaks in the Chocks.

220. In the chock and interior planking are frequently placed one or more circular coaks, to take the strain off the bolts, when, in rolling, the pressure is brought upon the head of the chock.

Upon the Plate Knees.

221. The plate knees (*n* and *a*) are formed with two arms; one extends along the side of the beam, from three to four feet, and is returned against the side of the ship about fourteen inches, or so as to receive two bolts; and the other, about $\frac{1}{4}$ out, down the chock, nearly the same distance. These two arms to the orlop, gun, middle, and upper decks, are supported by a brace (*c*) connected to each, nearly at the middle.

222. The knee plates are placed one on each side the beam and chock, immediately opposite to each other, so that the fore and aft bolts may pass through both; and they are let in for their outer surfaces to be fair with the outside of the chock and beam.

223. To the quarter-deck, forecastle, and round house, where the knee plates (*a*) have no brace, the arm connected to the chock has its lower end inclined towards the side, so as to bring it in the direction in which the motion takes place when there is a tendency for the beam to separate from the chock.

Upon bolting the Plate Knees.

224. The plate knees are bolted with from three to four bolts in each arm, and one in the brace; one of the bolts in each arm is placed immediately opposite the brace. The bolts are either collar or saucer headed (Note 58), and driven from each side alternately, and clenched upon a ring. The part of the arm that is returned against the side is bolted with two in-and-out bolts, collar headed, driven from the inside, and clenched upon the outside.

Upon the Fillings between the Beams.

225. Between the beams a filling (*e*) is placed, about one inch less in thickness than the clamps (142), with its upper edge well with the upper part of the beams, and of a breadth so as to leave an opening above the clamps of about two inches; this filling is fastened with the treenails that pass through the side in its wake, and the in-and-out bolts of the plate knees.

226. The method of securing the beam ends to the side, by chocks and plate knees, appears to have been a combination, that the labouring of the ship produced but little effect upon, so far as destroying its compactness; but as the association with the side is only local, it cannot be considered as adding any longitudinal strength, or as being complete.

227. The bolts that fastened the plate knees to the beams were formerly placed in the same

range of fibre, which order frequently caused the beam end to split; to remedy this disadvantage, the beam arms of the plate knees have been made of a serpentine form (x), and two up and down bolts driven about ten inches from each end at $\frac{1}{4}$ the breadth from the side of the beam.

228. The plate knees have sometimes been found broken at the part where the brace is welded to the beam arm, which may be caused by the parts not being properly incorporated; but most likely for want of sufficient strength at this place, as the principal action will be produced upon the brace when the ship is labouring.

Upon the method of uniting the Beams to the Side when the Union is assisted by a thick Waterway and Shelf (Fig. 30).

Upon the Shelf (Fig. 30).

229. The shelf (b) is a combination of timber ranging the whole length of the ship contiguous to the clamps (142), and fixed to the underside of the beams, for forming the whole of the side and beams in one compact union.

230. The shelf is broad from the clamps, at the upper part from 10 to 15 inches, and in depth below the beams against the clamps, from $5\frac{1}{2}$ to 9 inches, according to the rate of the ship and the deck it is connected with. The several pieces that compose it are united together with vertical scarphs, from five to six feet in length, and have four circular coaks in each. The scarphs are placed

between the ports, and for the front lip to be nearly well with the side of a beam, for a bolt to pass through it to an advantage.

(Fig. 35).

231. When the breadth of the shelf is such as to cause a great consumption of timber, to work it of a parallel breadth, the top ends of the tree are brought together and connected by an angular piece (*a*); the lips of this piece are brought the same in relation to the beams as the front lips of the scarphs; to the orlop and lower deck, instead of the lips being let in their whole thickness, they are sometimes only let in half. The angular or connecting piece is coaked to the shelf with five circular coaks in each piece.

232. The shelf, that is connected to the orlop beams, in all class of ships having the trussed frame (16), and to the lower deck of frigates at the extremities, instead of being contiguous to the clamps, is brought upon the timbers of the trussed frame, and the spaces between them from the shelf to the side are filled up by pieces called ekeings, of the same depth with the shelf; their outer parts are worked square, and project beyond the timbers as much as they fall in from a square, that the shelf may not be cut into at the lower part.

233. To the smaller class of ships that have no orlop, the lower deck shelf is brought against the timbers of the frame (66), and scarphed and coaked the same as to the other decks.

234. The front of the shelf, up and down, is worked in the direction of the chocks that are brought under them for receiving an iron knee.

235. The shelf is fastened with bolts, one placed about 12 inches from the middle of each beam, and the others at equal distances of from 18 to 20 inches; and immediately under the middle of the beams there is a bolt in it that passes through an iron knee; when this is not the case, a bolt must be added.

236. To the orlop, lower, middle, and upper decks, of two and three deck ships, and to the upper deck of frigates, there is placed in the shelf two circular coaks in each beam, and one in each beam to all other decks.

Upon the Waterways.

237. The waterways are pieces brought against the timbers upon the ends of the beam, extending the whole length of the ship; their thickness governs the distance of the lower edge of the spirketting (159) from the beams, which is worked upon the upper part; formerly, they were only formed for keeping the water from lying against the side of the ship, but now, they are formed for assisting in uniting the beams to the side.

238. The waterways are distinguished into thin and thick; the thin are those that form no part in securing the beams to the side; while the thick, though worked according to various methods, are always formed for aiding in the combination.

Upon the Thin Waterways (Fig. 26, 28, *and* 29).

239. The thin waterways (*m*) are in general worked from one to two inches thicker than the flat of the deck; but hollowed out, or what is called

chined down, to the thickness of the flat from the outer part of the spirketting. The inner edge is close to the timbers (66), and always of a breadth, or sufficiently out, to caulk the outer edge, or first seam on the flat; when the side tumbles home considerably, their outer edges are frequently inclined in the direction of the side, but no more than is necessary, as the caulking will have a tendency to bring it from the beams.

240. These waterways are always made as tight as possible between the beams and spirketting, that when the joint, or what is called the waterway seam, is caulked, they may be brought as firm as possible upon the beams; for it has always been found, that with all the force that can be used, this seam will still open when the ship is labouring in a sea.

241. The thin waterway is in general fastened as the flat of the deck, altogether with nails, or with nails in the beams and treenails in the ledges, and sometimes with an additional bolt placed in each beam.

Upon the thick Waterways, (Fig. 32).

242. The thick waterways (*n*), formerly, were formed according to various methods; but were worked in general, either for the beams to form a dovetail in a score taken out of them, or to have a circular coak in them and the beams. They had their outer edges formed for the flat of the deck to come against them, and caulked the same as the thin waterway.

243. These waterways were bolted down to the beams and through the side, according to the idea of the projector, but mostly, with two up-and-down bolts through the beams, and bolted through the side, with the bolts placed opposite to the flat of the deck, or above, from 20 inches to two feet apart.

(Fig. 30 and 31).

244. The thick waterways (*m*), now in general use, are of the same size each way, with their upper parts a little inclined downwards from the spirketting, to prevent the water lying against the seam, and with their inner or front parts rounded off. They rabbet over the flat of the deck three inches, so as to caulk in instead of up and down. The rabbet is above the beam the thickness of the flat of the deck at its inner edge, and inclined downwards, so that, at its inner part, it may be above the beam less than the thickness of the deck by $\frac{3}{8}$ of an inch; and the butts of the flat of the deck are taken off, or what is called bearded away, to correspond, for the convenience of getting them under and caulking.

245. These waterways have a score taken out of them, so as to face half an inch upon the sides of each of the main beams, and to let their lower side be below the upper surface from two and half to three inches; and when there are half beams (13) between the main beams, the scores are taken out of them, and not out of the waterway, to allow their being let down.

246. The butts are not, as is usual to other waterways, placed upon the beams, but between

them, so that they may be the least liable to yield where there is the greatest strain. To receive the butts, carlings to the breadth of the waterways are let down between the beams immediately under them, with their upper sides well with the upper surface of the beams and the lower part of the waterway, to the depth of the score, is taken off; and to give firmness and form a connexion, there are two circular coaks in the carling in each piece of waterway, on each side of the butt.

247. The waterways to the lower, middle, and upper decks, have two circular coaks in each beam, and to the other decks one; and when the side falls home, so that the waterway could not be got into its place on account of the circular coaks not being parallel to the timbers, pieces called ekeings (*e*) are wrought against the timbers, with their outer parts perpendicular to the upper surface of the beams, and of such a thickness at the upper edge, as to allow the waterway to rise what the coak is above the beam, without coming in contact with the timbers. The butts of the ekeings are placed clear, or to give shift to the butts of the waterway, and they score over the beams the same as the waterway.

248. The waterways are bolted with one up-and-down bolt in each main and half beam, and one in each butt, through the carling, unless the bolt through the half beam answer for the butt; the butt bolt is then omitted. The whole of the up-and-down bolts pass through the shelf, and are well clenched upon the underside; as the center of motion being on the outer part of the shelf, there is a great tendency for the beams to rise. The bolts

are therefore placed as far in at the lower side of the shelf as is practicable; and those through the beams stive clear of the chock.

249. There is one in-and-out bolt immediately over the middle of each beam and half-beam, about the middle between the upper part of the deck and upper part of the waterway; the bolts stive a little down, and are clenched upon the waterway.

(Fig. 30).

250. When the flat of the deck is laid diagonally (12), there is then, in addition to the waterway and shelf, a strake (*c*) called the side binding or letting down strake; it is from five to six inches deep, and ten inches broad, with its upper part fair with the upper surface of the beams, and its outer edge three inches from the inner edge of the waterway.

251. This strake is for forming the flat of the deck and sides of the ship in one continued combination, for which purpose it is firmly united to the beams and side; to the beams, by a score taken out of them the breadth of the strake, and from two and a half to three inches deep, and a score out of the strake sufficient to admit of its being let down, so that its upper part may be well with the upper surface of the beam; this score is faced on each side of the beam half an inch. The half-beams have a score taken out of them sufficient to let the binding strake down its whole depth.

252. To unite the binding strakes to the side, one bolt is driven in the middle between every

beam and half beam; these bolts pass through the lower part of the waterway, and are inclined a little upwards, and clenched upon the binding strake.

Upon the Chock under the Shelf (Fig 30 *and* 31).

253. A chock (*d*) is placed immediately under each beam, forming an abutment under the shelf, and at the lower deck (*m*) it extends to the orlop; in a frigate, it extends to the platform beams, and at the other decks to the spirketting (159), where they likewise form an abutment; and as the projection of the spirketting would form but a small abutment for the lower ends, the strake above, to the breadth of the chock, is taken away, from one inch to one and a half.

254. The chocks are from six to ten inches wide, or sided, according to the class of ships and the deck to which they are connected, and project from the interior planking at the upper part to be fair with the shelf, and with their fronts straight; those at the lower deck (*m*) project sufficiently at the lower ends to receive a circular plate that connects them to the orlop beams; at the other decks the lower end is fair with the outer part of the spirketting.

(Fig. 10).

255. The chocks (*m′*) under the orlop shelf are inclined as the timbers in the trussed frame (16), and extend down about four feet below the head of the timber that abutts under the thick strakes below the orlop clamps (144); this chock is fair with the outside of the shelf at the upper part, and answers for a connecting piece to the two upper timbers in

the trussed frame; it is bolted with six bolts, three in each timber; the upper one is about five inches below the shelf, and the others from 12 to 14 inches apart; they are clenched upon the chock.

Upon the Iron Knees, &c. connected with the Chock Shelf and Beam (Fig. 30, 31, *and* 32).

256. To form a firmer connexion between the side, beam, shelf, and chock, they are united together by *iron knees* (*e* and *a*) or *plate bolts* (*b*). To the upper deck of frigates, and to the lower, middle, upper and quarter deck, and forecastle, in ships of the line, are placed *forked knees* (*e*); to the lower deck of frigates, and to the quarter deck and forecastle in ships of 50 guns and frigates, and to the principal decks of the smaller class vessels, are placed *iron knees* (*a*) under the beams, and to the round house of all ships *plate bolts* (*b*).

Upon the Forked Knees (Fig. 30).

257. The forked knees (*e*) are made to clasp the beams to form an abutment under them, and to extend down sufficiently low to have one bolt in the spirketting (159), and at the lower deck, to have one in the thick strake over the orlop beams (147). These knees have five in-and-out bolts, one up and down, and at the lower deck three, and at all other decks, two fore-and-aft bolts. The in-and-out bolts are placed, one to pass through the shelf (229), and one through the upper part of the spirketting or thick strake over the orlop beams; the remaining bolts are placed, so as regularly to increase in distance from one to two inches from the upper one; they are in general driven from the inside and

clenched upon the out. The up-and-down bolt is driven through the throat or thick part of the knee, and passes through the beam and flat of the deck, and is clenched upon the flat. The fore-and-aft bolts pass through the beam, and are driven from the sides alternately, and clenched upon the opposite.

Upon the Iron Knees under the Beams (Fig. 32).

258. The iron knees under the beams (*a*) have one arm extending out from the side immediately under the middle of the beam, and the other down the chock. The arm connected to the beam is from two feet three inches to two feet nine inches, and is bolted with from three to four up-and-down bolts, which pass through the beam, and are clenched upon the upper part, or upon the flat. The arm that extends down the chock is similar to the up-and-down arm of the forked knee, and is bolted the same.

Upon the Plate Bolts (Fig. 31).

259. The plate bolts (*b*) are for keeping the beams down; they have a plate that extends down the chock, like the side arm of the forked knee, and bolted to the side, with the in-and-out bolts the same. Connected with the upper end of the plate is a bolt that passes through the beam, and clenched upon the upper part. For driving the bolt through the beam there is a shoulder formed upon the upper part of the plate, projecting from the outer surface about half an inch.

(Fig. 30).

260. To ships of the line, the orlop beams are secured at their ends, in addition to the shelf,

by a circular side plate (x), which lets into the side of the gun-deck chock (m) and orlop beam. These plates are placed on one side of the beam only, with their outer surfaces fair with the side of the chock and beam, and are bolted with four fore-and-aft bolts, two through the chock, and two through the beam; they are driven from the plate side, and clenched upon the opposite side.

261. The chocks to the lower deck of frigates abutt on the orlop or midship platform beams, as far as it extends, but have no side plates connected with them.

262. The beams to the orlop and platform, and the foremost and aftermost beams of the lower deck *in frigates*, and the whole of the lower deck beams in the smaller class of vessels, have three bolts in each, driven through their ends from the outside, and clenched upon the beams.

Upon the Riders.

263. Riders are interior timbers placed upon the inside planking for giving additional strength; those below the lower deck, are in two and three deck ships; and in bombs, under the bomb beds; they are placed to some extent in the full part of the ship, for giving support to the body when it takes the ground, and against the pressure of the fluid, especially the vertical pressure in the neighbourhood of the keel. The riders above, were in general placed in all classes of ships, and extended nearer to the extremities; they were for supporting the upper works.

264. The riders below the lower deck are distinguished into floors; first, second, and third

futtock riders; and that they may act in conjunction in giving support to the body below water, they were formed into bends. Three deck ships had in general eight, and two deck ships six bends on each side; five of which in three deck ships, and four in ships of two decks, were connected by floor riders.

265. The floor riders were mostly placed over the first futtocks in the frame (65), and extended from 12 to 16 feet on each side of the middle. The first futtock rider was placed to the side of the floor, when there was one connected with the bend, and had its lower end from two to four feet from the keelson, and extended from seven to nine feet above the head of the floor rider. The second futtock rider scarphed or abutted on the head of the floor rider; if it abutted, it was connected to the floor by a chock and extended to the orlop beams. The third futtock rider scarphed or abutted upon the first, and extended to the gun deck beams, and if it formed an abutment upon the first, they were connected by a chock; this rider was in general faced upon the orlop beams and bolted through them with two bolts.

266. The first futtock riders were in general connected from opposite sides by a cross chock, scarphed with a hook and butt scarph upon the heel of each; the scarph was from four to five feet in length, and had three small bolts in the upper lip.

267. The floor riders were bolted with from 10 to 12 bolts, the cross chocks with from 6 to 8, and the second and third futtock riders with from 7 to 9 in-and-out bolts. The bolts that could be driven from the outside were clenched upon the

riders, the others were clenched upon the plank of the bottom.

268. The riders were likewise bolted to each other, with from 2 to 3 fore-and-aft bolts in each over launching part, and the cross chock to the floor rider with from 6 to 8.

269. The riders above, were for supporting the topside, and were distinguished into the breadth, middle (sometimes to three deck ships), and top riders. The *breadth riders* extended from within 6 inches of the upper side of the orlop beams to the under side of the middle or upper deck beams, according to the class of ship. The *middle riders* had their lower ends sufficiently clear of the lower deck waterway seam, and extended to the under side of the upper deck beams. And the *top riders* were placed with their lower ends clear of the middle or gun deck waterway seam, according to the class of ship, and extended to the under side of the quarter-deck and forecastle beams.

270. The breadth riders were in general 13 on each side in three deck ships, and 12 in two deck ships; they were bolted with from 9 to 11 in-and-out bolts. The middle riders, when three deck ships had them, were 13 on each side, and bolted as the breadth riders. The top riders were in three deck ships 13, in two deck ships 12, and in frigates from 8 to 10 on each side, and were bolted with from 9 to 11 in-and-out bolts; the whole of these riders were in general placed in a diagonal direction, not that this direction could give any support to the body, but that they might be placed in the best manner in relation to the beams and ports; and

it was considered that by their crossing several timbers (66), which this position would effect, additional strength would be obtained; but as the bolt had no support transversely, the riders could resist no other strain than that which was communicated in the direction lengthways of the bolts. These riders were formed with a swell in-and-out, at the decks, and had their ends rounded; when they were brought against the side of a beam two fore-and-aft bolts were driven through them and the beam.

Upon the Support formerly given to the Topside without Riders.

271. When the riders above were omitted, the topside used to be supported by knees, similar to inverted hanging knees, placed immediately over the beams, and against the side, called standards; extending out from the side, from three feet six inches, to four feet six inches; and above the deck from five feet to six feet. There were in general from nine to twelve on each side, fixed to a piece upon the deck, called a sholes, from three to four inches in thickness.

The standards were of wood or iron; and in general bolted with nine bolts, four up-and-down, and five in-and-out; the up-and-down bolts were collar headed, and driven from the upper part of the standard, and clenched upon the under side of the beam. In general, the toe bolt was driven through a plate that clasped the standard, as in the working of the topside there was a great tendency for the toe to separate from the deck, and frequently to split. The in-and-out bolts were driven from the outside, and clenched upon the standard. When the standards were of iron, the whole of the bolts

were collar headed; and the in-and-out bolts were then driven from the inside.

Upon Single Riders in the Hold (Fig. 10).

272. Single riders (m'') have been partially introduced into ships of the line, instead of the method of forming the riders into bends (264). These riders were in one piece, and placed immediately under the orlop beams, with the chocks (216) that united the orlop beams to the side, scarphed upon their heads, and extending down within five or six feet of the keelson, or so as to give good shift to the floor heads. These riders were about twelve in number on each side, lying in the full part of the ship, between the fore part of the fore hatchway and the after part of the after hatchway.

273. The bolts in the single riders were from 16 to 18 inches apart, placed upon alternate edges, about one-fourth from them. Where it was practicable, the bolts were driven from the outside, and clenched upon the rider; where it was not, they were driven from the inside, and clenched upon the plank of the bottom.

Upon the Alterations of the Internal Structure.

274. The internal structure of the ship has been entirely changed, with a design to give a greater degree of rigidity to the body, and to save materials.

275. The rigidity, or the resistance which the body opposes to any alteration of form, has been increased by substituting a trussed frame, &c.

(13) instead of the common riders ; and a saving of materials (Note 59) has been effected by taking away the foot-waling (132), and filling in the openings between the timbers of the frame (66).

276. To increase the resistance to any alteration of form, must be of the greatest consequence in structures like ships, because they are not erected to continue upon an immovable foundation, and to sustain merely the weight of the components, but to float in an agitated sea, where the forces produced by the wind and waves are changing every instant; and being composed of materials that are neither perfectly combined, nor perfectly elastic, they cannot react with forces equal to those impressed, to recover their former figure; but must, according to the degrees in which they yeild, be affected so as to destroy that combination and close union of the parts, which existed in the original structure. In degrees, corresponding as the deformation takes place, will the fastenings be acted upon, and the want of a firm connexion between the different parts, will allow a movement among them, which is commonly called working; and when with respect to the combinations the timbers are once separated, they cannot unite again so closely as in the primitive state; but will, while the different forces operate, be continually increasing the working of the parts, and producing more and more dangerous effects upon the system.

277. In the present mode of giving firmness to the fabric, it is intended, that the parts shall be so disposed as to prevent an improper action being brought upon the fastenings, when a longitudinal bending takes place, while the pressures will be received with the least possibility of causing a de-

rangement under the common forces that act upon the body. These advantages are obtained principally by the shelves (229), called internal hoops (Note 60), which increase the resistance to extension; by filling in the openings between the timbers, which increases the resistance to compression (13); and by the trussed frame, which opposes a resistance to any change of state, by the abutments of its components.

Upon the Shelf or Internal Hoop.

278. The shelf (229), in common with the interior and exterior planking, and other parts of the structure, that form longitudinal ties, oppose a resistance to extension; but the shelf in a greater degree, on account of its substance, and the firmness with which it is combined to the different parts of the ship.

Upon filling in the Openings between the Timbers.

279. The openings between the timbers where filled in formerly no higher than the floor heads, but now they extend up, in all ships having orlops, within four inches of the strakes under the orlop clamps (144); and to smaller vessels, within four inches of the strake under the lower deck shelf, if there is one; if not, within four or six inches of the under side of the shelf; their upper ends are formed to an inclination downwards, from the outer part, below an horizontal line, that the water which passes between the timbers may run into the hold.

280. The fillings between the timbers were formerly the same breadth in and out as the timbers themselves, and when the openings were more

than three inches, the range of fibre was placed in the same direction as the timber. These fillings were formed wedge-like, so that one of them might be driven from the inside or out to give firmness. When the openings were less than three inches, they were likewise formed wedge-like and driven from the inside and out opposite to each other, with the range of fibre perpendicular to the timber. In both cases the fillings were caulked upon the same edge, inside and out, for the oakum to meet; upon the other edge, and at the butts of the timbers, and fillings, they were only chinced (Note 61).

281. The fillings are now, from frigates upwards, put in from the outside and in, with the range of the fibre the same as the timbers, of about three inches in depth, and of such lengths as can be provided out of offal timber. The butts of the different lengths rabbet over each other to form a stop for the oakum. When the outer fillings are caulked, which it is upon both edges, those in the interior of the ship are taken out, and the space between the fillings filled in with a composition (Note 62). The interior filling is replaced and caulked as the outer fillings.

282. The smaller class of vessels have now the openings between the timbers filled in with fillings, having the range of fibre the same as the timbers, and of the same breadth with them, and of any lengths that can be got out of offal timber, so as to give shift to the heads and heels of the timbers. These fillings are well caulked inside and out.

283. Before the keelson (88) is got into its place, in all classes of ships, the fillings are put in

so as to extend to some distance on each side, and are well caulked.

Upon the Trussed Frame (Fig. 10 and 33).

284. The trussed frame is a combination of timbers (13) brought in contact with the frame of the ship (65), below the thick strakes under the orlop clamps (144), and above upon the interior planking; it is for supporting the ship against bending in the direction of its length, which all ships, according to their strength, form, or stowage, are subject to, more or less, and as a substitute for the foot-waling (132) and the former riders (263). This frame is composed of timbers, or riders, fore and aft, or longitudinal pieces, and trusses. The timbers or riders may be considered as braces or principals in this frame; they are laid at an angle of about 45° vertically, with a longitudinal line, inclined forward in the after body, and aft in the fore body. The longitudinal pieces are placed between the riders, immediately over the heads and heels of the timbers in the frame (66), forming an abutment against their sides, to prevent their mutual approach; these therefore, with the aforesaid riders, form rhomboidal spaces. The trusses are inclined in a contrary direction to the riders, forming an abutment against their sides, and dividing the rhomboids into triangles.

Upon the Timbers or Riders (Fig. 10 and 33).

285. The riders or timbers (x) in ships of the line are in three lengths, with the two lower timbers scarphed side by side; the lower timber (x') extending from the limber strake to about two feet

six inches above the floor head, on the aft side of the middle timber in the fore body, and fore side in the after body; the middle timber (x'') extends from about two feet six inches below the floor head to about a foot below the lower edge of the thick strake under the orlop clamps; and the upper timber (x''') abutts on the middle, and extends up within about six inches of the gun deck shelf (229), and snapes against the gun deck chock (253); and that they may not snape too much, and have the proper inclination, the aft side of the orlop beams in the fore body, and fore side in the after body, have six inches if required, taken off their lower angle. The two upper timbers are made to correspond at their abutments, and as a connecting piece to the two, a chock is brought under the orlop shelf (255), and to give a proper scarph, it extends down about four feet six inches below the upper part of the middle timber; this chock, at the upper part, is fair with the outside of the shelf, and the lower end is rounded off.

286. The upper timber has one circular coak in one of the thick strakes under the orlop clamps, and one in the lower strake of the lower deck clamps; the middle and lower timbers have them placed in the timbers of the frame (66), one about a foot above and one a foot below the joint, or heads and heels; the lower timber has likewise two others, one of them about a foot from the lower end, and the other near the middle.

287. In frigates the timbers or riders are in two lengths; the upper one extends, from about six inches below the lower deck shelf, to the longitudinal piece at the floor-head. Three o

these timbers, at each extremity, extend from the same distance below the upper deck shelf; the lower timbers extend from the limber strake, except forward and aft, where they meet at the middle lines and are made to form hooks or crutches, by their being united by a circular iron plate, as Fig. 34; to form an abutment against the truss, as the lower timber in the fore body is placed on the aft side of the upper, and in the after body on the fore side.

Upon Bolting the Timbers.

288. The upper timber has an iron plate about 12 inches from the upper end, with two bolts passing through it; the next bolt is placed about 14 inches down from these two, one passes through the middle of the shelf (232), and one about five inches above; the intermediate bolts between this and the one under the plate, are about 18 inches apart; the middle timber has one about six inches from the lower end, the next 12, and the remaining bolts from this to the lower bolt in the chock are about 18 inches apart. The lower timber has one bolt about six inches from each end, and one about 18 inches; the other bolts are spaced, between these, to be about 18 inches apart. The chock under the shelf, or connecting piece to the two upper timbers, is bolted with two bolts opposite to each other about five inches below the shelf, and two about eight inches from the lower end; between these, two bolts are placed in each timber nearly at equal distances apart. The whole of the bolts are placed upon alternate edges; those at the ends and one between, in each timber, are driven from the inside and clenched upon the outside

plank; the remaining bolts are driven from the outside and clenched upon the riders. In frigates the timbers or riders are bolted the same as in ships of the line, unless there is no chock. The scarphing or overlaunching of the diagonal timber, or where they come side by side, is bolted with two fore and aft bolts.

Upon the Longitudinal Pieces (Fig. 33).

289. The longitudinal pieces (*n*) are brought immediately over the joints of the floor and first futtock heads, with their abutments fitting closely between the diagonal timbers, and are of the same depth in and out. These pieces have one circular coak in each end in the diagonal timbers, and are bolted, with two bolts, about eight inches from each end, abreast of each other; and between them, as many bolts as the space will admit of, at equal distances of about 20 inches. The end bolts and one in the middle are driven from the inside, and clenched upon the out; the remaining bolts are driven from the outside, and clenched upon the longitudinal pieces. In frigates, such of the treenails as compose the security of the outside planking and will make good fastenings, by passing through these pieces at a proper distance from the edge, are made to answer for part of their fastenings, and only as many bolts driven through them, as to make up the deficiency in addition to the end bolts.

Upon the Trusses (Fig. 33).

290. The trusses (*y*) are placed in the diagonal of the rhomboid, formed by the timbers and longitudinal pieces, and abutt as firmly as pos-

sible against both. They are of the same depth as the other parts of the trussed frame, and are bolted, with one bolt about eight inches, and another about 20 from each end, on opposite edges. The other bolts, between these, are at equal distances apart of about 20 inches; but in frigates, when the treenails will form a proper fastening, only such bolts, in addition to those at the ends, are added as may be necessary.

Upon the Resistance the Truss Frame opposes to any Longitudinal Bending.

291. It is difficult to give to the body of ships sufficient stiffness to overcome the tendency they have to arching, or sinking at the extremities. It is therefore of consequence, in the distribution of the materials, that such a combination should be made, with the different assemblages, as to give a general support; and such a disposition as not to cause a separation, opening, or working of the several parts of the structure, when the body is bent. To obtain this object, the components of the trussed frame are uniformly distributed throughout that part of the body, which has to receive the stress when arching takes place.

292. When the body arches upward, or is hogged, the deflection commences at a certain distance afore and abaft the middle; within this limit the body is stationary, or if any alteration takes place, it is a bending downwards, or sagging, rather than arching upwards. From the neutral or stationary points, any parts that before formed right lines will now become by the arching curvilinear. And supposing the union of all the parts

to be complete and unchanged, the parts above will be thus extended, and those below compressed; but if this union and combined support be overcome, the different parts will drop, and the angles formed before by the timbers and planking, &c. will be altered.

293. With a trussed frame this arching is so inconsiderable as to remove all its disadvantages, for the body can arch no more than to bring all its parts into an uniform action, except what the flexibility of the materials of which the whole frame is composed will allow; for through the inclination of the riders, the ends towards the extremities must be depressed more than the others, because their distances from the neutral points are greater; therefore if the upper ends of the riders were inclined towards the extremities, they would resist arching by compression; but if inclined in the contrary direction, or as they are at present placed, by extension. It is therefore evident, that arching cannot take place, without destroying the strength of the fibre in one case and the fastenings in the other. And since if the timbers were applied as in the first case, and brought into action by compression, they would tend to produce extension on that part of the fabric, which by its position, becomes extended by any bending; one support would be thereby endangered, in order to obtain another. But supposing, as in the second case, the riders to be inclined from the extremities, they act solely as braces, and put the whole frame in action to resist any alteration of form; without themselves acting partially, or producing any derangement, as the stress is then communicated more generally.

294. The riders have been considered as right lines; whereas in practice they are curved to the form of the body, but it is shewn, that the chords must be elongated or shortened according to the manner in which they are inclined; the curve also must be lengthened or shortened, which will be prevented by the fastenings.

295. Again, to allow the body to arch, the riders must approach each other; but they are prevented from approaching by the longitudinal pieces. The body therefore cannot arch till acted upon by a force sufficient to destroy the strength of fibre of these pieces. In the same manner, no change can take place without altering the angular positions of the rhomboids that are formed throughout the frame; and as their perimeters will remain the same under every change that takes place in their angles, the diagonals of the rhomboids must be lengthened or shortened; and since the riders must approach each other under any alteration, and the trusses form the diagonal that would be shortened, they also must suffer by compression; and in order for the body to assume a new position, they must yield, which cannot take place, because the pressure produced by their abutments is uniformly resisted throughout the frame; consequently the body cannot bend (no more than the imperfection of the materials and workmanship will admit) while the strength of the longitudinal pieces and trusses is able to resist any forces that may act upon the body.

296. The strain produced upon the trusses and longitudinal pieces by compression, has a tendency to force the body out; but, as the riders

will sustain the whole pressure, they will resist it, by being brought into a state of extension; whereas if they were placed in the contrary direction to what they are at present, they would act with the trusses; and the result would be, that when the body was powerfully acted upon, racking motion or working would take place in the materials.

Upon the Iron Riders or Trusses.

297. The iron riders are placed in the larger class of frigates instead of the trussed frame; they are composed of iron plates, of about six inches broad, and one inch and a quarter in thickness, and are in two lengths. The upper length extends from about four inches below the lower deck shelf to about three feet below the first futtock head; the lower one, from three feet above the first head to such a distance down, as to receive two bolts below the floor head; though sometimes, in frigates of 46 guns, they extend no lower than to receive a bolt through the thick strakes upon the floor heads, especially when it is not the small timber frame (82), as then the floors do not extend out so far.

298. These riders or trusses are placed to about the same inclination as the timbers in the trussed frame (284), but inclined with their upper parts forward in the fore body, and aft in the after body, and as low down as the thick strake upon the ends of the orlop or platform beams. They are brought upon the plank, and below, in contact with the timbers (66). The bolts in these trusses are from 18 to 20 inches apart, with one always placed about four inches from each end.

Upon the Thick Strakes worked over the Joints of the Timbers.

299. To all ships without the trussed frame there are thick strakes worked over the heads and heels of the timbers. To give firmness to these joints, in brigs, there are in general two worked over the floor heads; in all other classes of ships, there are two worked anchor stock (97) over the floor and first futtock heads; and to the smaller class of ships without the midship platform, that have neither the trussed frame nor iron riders, there is, in general, a thick strake worked below the lower deck shelf. The thick strakes are always brought over the iron riders, in those ships that have them, and the bolts that come in their wake are driven through, and clenched upon them.

Upon the Framing of the Deck.

300. The framing of the deck consists of half-beams, carlings, and ledges, or all that may be placed for supporting the flat, in addition to the main beams. It is for giving firmness, both for supporting the artillery, and when caulking the seams of the flat (10).

301. The framing consisted, formerly, chiefly of carlings and ledges. In ships of three decks, there were, in general, from three to four tiers of carling, and in other ships from two to three, ranging fore and aft, between the beams; one tier with their midship sides ranging with the inside of the hatch and ladderways, and one tier about six inches within the toes of the knees; the other tiers, if more, were placed equally between. These

carlings varied in size according to the deck and rate of the ship, from 6 inches to $11\frac{1}{2}$ in breadth, and from $4\frac{1}{2}$ to $16\frac{1}{2}$ inches in depth. Extending from carling to carling; and from the carling without the toe of the knees to the throat of the lodging knees, or to a filling let down on purpose, were ledges, lying parallel to the beams, with the common distance between them, about 12 inches; though they varied according to the space between the beams, from 10 to 16 inches. These ledges were in breadth from three to six inches, and in depth from two and a half to five inches, according to the deck or class of ship.

302. The carlings were scored upon the beams, at the upper part, from one and a half to one and one-eighth inches, with the score less at the lower part about one-eighth of an inch; and the ledges were scored into the carlings, with a score about one-fourth of an inch less than those for the carlings.

303. Instead of ledges to the upper and middle decks, abaft the mizen mast, there were, in general, placed half-beams; they varied in breadth from seven to eleven inches, and in depth from five to ten inches. The carlings that received the midship ends of the half-beams, and those to receive the comings, were from three quarters to one inch and a half broader than the other carlings.

304. In the present mode of framing the deck, one or more half-beams are introduced between each main beam, in place of the ledges; they are of more substance, and are combined to the carlings and ship's side, so that a greater degree of

firmness is not only given to the flat, but the side and flat are united more as one combined mass; instead of an unconnected assemblage of materials, as it was with the ledges (Note 63).

305. To receive the midship ends of the half-beams, carlings are let down between the main beams. When the deck is laid fore and aft (9), one tier on each side is placed with their midship sides ranging with the inside of the hatchways; excepting where the masts, pumps, capstan partners, and standard to the riding bitts require the carlings to be placed differently to comform to them. With the diagonal deck, one tier, ranging the whole length on each side, is placed with their midship edge, at such a distance from the comings, that the side edge of the two binding strakes may lie about two inches upon them; and, to receive the comings, capstan partners, standard to the riding bitts, pumps, &c. others are let down at their proper distances from the middle line.

306. The half-beams are placed one between each main beam, except in the spaces between the beams that form the hatchways and mast rooms, where there are in general two; they have their side ends abutting against the timbers of the frame (15), and resting upon the shelf, to which they are connected with one circular coak. Their midship ends are scored into the carlings, and are secured to them with a plate or dog bolt; the bolt passing through the carling, and clenching upon it, and the plate bolted with one or two fore-and-aft bolts through the half-beam, and clenching upon the opposite side of them. The half-beams are of fir, excepting under the cable tier, where they are of

oak, and are of the same depth as the carlings, only that their side ends as far out as the shelf to the fore and aft decks; and from 14 to 20 inches without the letting down strake (250) to the diagonal deck, they are left the same depth as the main beams, to rest upon, and coak to the shelf.

307. When the flat is laid diagonally, from two to three tier of ledges are let down between the half-beams, and half and main beams; they are from nine to ten inches broad, and from four to five inches deep, and are laid at right angles to the direction of the strakes of the flat; the side tier have their side ends about 12 inches from the side binding or letting down strake (250); and the midship tier, with their midship ends, about two feet from the carlings that receive the side edges of the midship binding strakes, and midship ends of the diagonal deck. These ledges, as well as all the carlings, are of oak.

308. Between the carlings in midships, and between the carlings for the midship binding strakes, and those for the comings, ledges are let down, to give firmness to the flat in these parts; and in general, on the aft side of the riding bitts, a ledge is let down, as broad as the bitts; and frequently these bitts, as well as all others, are framed on each side of them, to form a stop for the oakum, in case of their working. And in all cases where scuttles are placed in the flat, and for the wing gratings, carlings or ledges are first let down to form them.

Upon the Flat of the Deck.

309. The flat of the deck is the flooring or covering over of the beams and framing with

planks or deal, from two to four inches in thickness. To the lower or gun deck of ships of the line, the flat was formerly laid with four-inch Dantzic plank, extending in strakes, curved as they approached the side, the whole length, with the second and third strake from the comings on each side, forming binding strakes, for which purpose they were one inch thicker, and scored over the beams and ledges the additional thickness; this flat was fastened with two three-quarter inch short bolts in each beam, and one deck treenail in each ledge, in every strake. The flat of all other decks were mostly of Prussian or Dantzic deal, with the strakes extending fore and aft, excepting two strakes next the comings, which were oak for binding strakes, one inch thicker than the common flat, and scored over the beams and ledges as before described, and frequently between these strakes in midships was oak, especially to the upper and middle deck, with the strake at the middle line one inch thicker, to place the pillars upon; and sometimes from three to five strakes out from the side they were likewise of oak, to train the guns upon; the flats laid in this manner were fastened with deck nails in general, two in each beam, and one in each ledge, in every strake.

310. The butts of the binding strakes were always placed at the greatest distance possible from the hatchways, mast partners, and riding bitts, and the score over the beams always as tight as possible, and they were mostly faced upon the beams.

311. The fore-and-aft decks are now laid with fir, except the two strakes next the comings, which are oak, and one inch thicker; but instead of being scored over the beams as the other binding strakes, they project above the flat, and have one

circular coak and two bolts in each beam; these flats are fastened with two nails in each beam, and one in each half-beam, in every strake. The weather decks are fastened with nails made of mixed metal (Note 11); the other decks with iron.

312. When the flat is laid diagonally, which is the case now, to the lower, middle, and upper decks of ships of the line, to bring the strakes to act as braces in combining the beams and sides of the ship in one compact association (251), the strakes are laid to an angle of about 45°, with a fore and aft line; these strakes have their midship ends abutting against two binding strakes, that range the whole length, and their side ends abutting against the waterways, which rabbet over them (244). Each strake is fastened at the side butt with two treenails through the side binding or letting down strakes (250), excepting when the up-and-down bolt in the forked knee (257) passes through their ends, or when their ends come over a half-beam (in which case, a bolt is driven in their ends, letting down strake, half-beam, and shelf, and clenched on the under side of the shelf), when only one treenail is driven in each end. The treenails pass quite through the letting down strakes, but those in their ends, that pass into the main beams, are to be no more than from nine to ten inches in length; only one is to pass through the half beam. The midship butts are fastened to the main beams or carlings (305), with two bolts in each butt; between the butts each strake is fastened to every main beam with two bolts of 5-8ths of an inch diameter, and to every half beam with two, and every ledge with one treenail. The bolts in the beams are from eight to eleven inches in length; but the holes for them are bored quite through the beams.

313. The binding strakes, which are two on each side, for receiving the abutments of the diagonal decks, are one inch thicker than the flat, and each strake has one circular coak of $3\frac{1}{2}$ inches in diameter, and two up-and-down bolts in every beam, and are treenailed, with one deck treenail in each ledge.

Note.—In the alphabetical index at the end, will be found a description of the more minute parts of the structure, as the head, stern, capstan, bitts, blocks, comings, &c.

A DESCRIPTION OF THE MASTS, YARDS, &c.

Masts.

314. The masts are distinguished into the lower or standing masts, topmasts, and topgallant masts. Masts have three parts, the body, the hounds, and the head; from the lower end to the upper part of the hounds, which is likewise called the stops, is called the hounding; from thence upwards, the heading; above the head to topgallant masts it is called the poles; the lower one is called the royal pole, and the upper one the skysail pole.

Upon the Lower Mast.

315. The lower masts are distinguished into single tree, single tree masts cheeked, and made masts; *single tree,* when the whole mast is formed of one single tree or piece; *single tree cheeked,* when one piece extends the whole length, and gives the full size of the mast the fore and aft way; and athwartships, to half the given length from the lower end; above which it is reduced so as to be at the upper end $\frac{6}{35}$ of the given diameter, in order to take off the knotty part of the stick, and to give strength to the masts, by bringing upon its sides the cheeks. *Made masts* are composed of several pieces, as the spindle (which is the main piece, and in large masts is frequently in two), the side trees, fishes, and cheeks.

Upon the different parts of the Masts, where the Diameters and several Proportions are set off.

316. The given diameter is always at the partners; at the middle deck in three deck ships and yachts that have one, and at the upper deck in all other ships. Below the partners, the mast is divided into four equal parts, which are called the lower quarters, and are marked thus, 1st, 2d, 3d, and heel. From the heel or lower end of the mast the given length is set up, and when the length is not given in terms of headed and hounded, $\frac{1}{36}$ of it is added for an additional length of head; then from the extreme length $\frac{1}{6}$ of the given length is set back, which gives the length of the head and place of the stops or upper part of hound (314). From the stops to the partners it is divided into four equal parts, which are called the upper quarters, and marked thus, 1st, 2d, 3d, and stops and head; at the heel the mast $\frac{5}{6}$, at the hounds $\frac{3}{4}$, and at the head $\frac{2}{3}$ of the given diameter. Between the heel and partners, and partners and hounds, or at the upper and lower quarters, the mast is graduated according to certain proportions, which have been found by experience to make it uniformly strong.

Upon the Proportion given for the Quarters.

317. The parts between the heel and partners, and partners and hounds of a standing mast, and the cap and hound of a topmast and topgallant mast are formed to a certain curve, which is obtained by the following practical method. Divide the difference between the given diameter, and the proportion given for the heel, hounds, &c. (316) into

4 parts; for the third quarter it is $\frac{1}{2}$ the difference, for the second $\frac{1}{5}$, and for the first $\frac{1}{15}$, the difference less than the given diameter, which will give a curve that approaches nearer an arc of a circle than any other known curve. The method used by the mast makers to facilitate their setting off the different proportions at the quarters, &c. is by a small batten, called the graduating batten, upon which they mark from one end a distance equal to $\frac{1}{2}$ the given diameter, and another distance equal to $\frac{1}{2}$ the proportion for the heel, hounds, &c. (as in forming the mast all proportions are set off from a straight line at the middle, which represents the axis) half the differences between these two distances is marked for the third quarter, $\frac{2}{5}$ of this half from the given diameter for the second quarter, and again $\frac{1}{3}$ of the $\frac{2}{5}$ of the $\frac{1}{2}$ for the first quarter.

Upon a Single Tree Mast.

318. When the length of the hounding and heading of the mast is not given separately, $\frac{1}{36}$ is added to the given length for an additional length of head (316), and the whole length of the head is made $\frac{1}{6}$ of the given length for the main and fore masts, and $\frac{5}{36}$ for the mizen masts when they step in the hold, and $\frac{11}{72}$ when they step on the lower deck; at the lower part of the head are the hounds or stops; from the lower end the height from the step of the mast to the deck is set up, which is called the partners, where the mast has the given diameter, and is divided into four parts each way, from the partners to the heel, and from the partners to the stops for the upper and lower quarters, at which places, and at the heel, hounds and head, the different proportions of the given diameter are set off, and

the mast is formed to them the fore and aft way, but athwartship it is made straight from the third upper quarter to the head, instead of attending to the proportion given at the hounds. All masts are first made square, and then such parts as are to be rounded, formed to eight squares, sixteen squares, and so on, till they are made cylindrical. They are left square below the stops $\frac{2}{36}$ of the given length, for the hound pieces, and above once and half the depth of the trestletrees for the trestletrees, &c.; above, the mast head has the four angles rounded off (Note 64), and below the square it is formed into the round, or what is called hanced into it, with an hance about $\frac{5}{6}$ the length of the hounds, below which it is made cylindrical.

Upon the Hounds Pieces.

319. The hounds pieces in single tree masts are formed with the knees in one piece; they are in thickness half the thickness of the trestletrees, but never less than three inches; in breadth, the same as the mast head, and in addition for the knee, which is formed on the fore part for supporting the trestletrees, the diameter of the topmast; and in length, $\frac{2}{5}$ the length of the head, without the additional length, or $\frac{2}{36}$ the given length of the mast. The lower end is formed to a semicircle, and is reduced, or what is called bearded, to half its thickness, and to half its breadth up, from which place the forming in of the lower end of the knee terminates. To bring the fore part of the knee nearer to the outer part of the trestletrees, the after part of the hounds piece, on the side next the mast, is reduced from $\frac{3}{8}$ to $\frac{3}{4}$ of an inch; their outsides are sometimes formed a little hollow to correspond.

320. The hounds pieces are coaked to the mast either by two square coaks formed out of the mast, or by circular coaks, and are bolted with five through bolts, driven through from alternate sides, and clenched upon the opposite; they are placed, the two upper and two lower bolts, about $\frac{1}{5}$ the diameter of the mast head from the fore and aft sides, the two upper, down, about nine inches from the stops, and the two lower $\frac{2}{6}$ the length of the hounds from the lower end; the other bolt is placed in the middle line of the mast, and at equal distances from the upper and lower bolts. A strengthening bolt is driven fore and aft, through the knee and hounds piece, just above the two upper bolts; the lower end is nailed with about six nails, two inches from and following the curve of the end.

To hoop the Mast.

321. Hoops are placed upon single tree masts, in general, both at the head and heel, at the head about five in number, and two at the heel. The number and place of those at the head should be governed by the knots, placing the upper one as near to the tenon, for the cap, as possible, and the lower side of the lower one once and a half the depth of the trestletrees from the stops, or at what is called the calf's tongue; but if there are knots, they may be removed four or five inches to cover them; one, two, or three are placed between these, according to the knots in the mast head, and fixed over those that are the worst collared (Note 65).

Note.—The hoops at the heel are placed with the lowest about fourteen inches from the

heel; and if the heel should be shaken, two others are placed above it, from $2\frac{1}{2}$ feet to three feet apart; if the heel is sound, one only is placed upon it.

Upon Single Tree Masts cheeked.

322. Single tree masts are cheeked, to give additional strength, and to take off that part of the top end of the tree which is frequently knotty. Masts from $18\frac{1}{2}$ inches and upwards are in general cheeked (Note 66); the quality of the timber rather than the diameter of the masts determines it. The main mast of brigs, when they have no trysail mast, must be got without cheeks, on account of working the gaff. These masts have the proportions set off, and formed the same the athwartship way as single tree masts; but the fore and aft way as high up as the lower end, or tail of the cheek, from which place they are made straight, or formed with a tongue, to the head where they are $\frac{6}{35}$ of the given diameter.

Upon the Cheeks.

323. The cheeks are brought on each side of the mast, and extend down from the head half of the given length, beside the additional head; they have the sides that fay to the mast straight lengthways, and are in thickness at the lower end $\frac{5}{27}$, at the hounds $\frac{9}{37}$, and at the head $\frac{1}{4}\frac{1}{8}$ of the given diameter; the length of the head and place of the hounds are determined the same as for single tree masts; at the hounds half the thickness of the trestletrees is set without the proportion, for this place, to form the stops; they are straight lengthways, from the outer part of the stops to the lower end, and from the hounds to the head.

324. The cheeks correspond in breadth with the mast the fore and aft way, from the head to the lower part of the hounds, from which place they are made straight to the lower end, or tail, where they are in breadth half the given diameter. In the same manner, and the same distance above the stops, the cheeks are rounded, and the length of the hounds and hance the same as masts that head themselves (318); but below the hance they are rounded, transversely to a margin upon their edge, which is up from the sole or faying surface $\frac{2}{7}$ of its thickness at the lower end, and $\frac{5}{12}$ at the hance; except when they are fished on the fore part (Note 67); the lower end of the cheek is rounded to a semicircle, and the margin is carried round the end, to which it is bearded.

To hoop the Cheeks and place the Circular Coaks.

325. The first hoop is placed half an inch below the stops, which is called the hound hoop; one with its lower part once and a half the depth of the trestletrees above the stops, and two at the head, one about 3 inches below the tenon, and the other 2 inches below it. Between the lowest hoop of these two and the one above the stops, to a mast of 23 inches in diameter, three hoops are placed; from 23 to 30 inches, four; from 30 to 33 inches, five; and from 33 inches in diameter upwards, six; at equal distances apart. Below the hounds the hoops are made to clasp (Note 68), as it would be impracticable to drive them; one is placed from 20 to 21 inches below the lower part of the hounds, and the lower one above 12 or 14 inches above the tail of the cheek; between these, three or four others are placed at equal distances.

326. The circular coaks are placed in the mast head, above the stops, one under each hoop, upon alternate edges, about their diameter from the edge of the cheek; in the wake of the hounds, three on each side, one about 9 inches from the stops, and one about 9 inches from the lower part of the hounds, on opposite edges upon opposite sides; one on each side is placed in the center, immediately opposite to each other, so that four bolts of the five that are driven through the hounds pass through one coak each, and the other bolt, the centre, through the two coaks that are opposite to each other; and below the hounds they are from two feet to two feet six inches apart; the lower one is about 9 inches above where the cheek is hollowed.

To Bolt the Cheeks.

327. One rag pointed bolt is driven through each circular coak, about the substance of the cheek, into the mast, except through those coaks in the wake of the hounds where the bolts are driven through from alternate sides and clenched. In the mast head, one through bolt is driven between each hoop in addition to the rag bolts; and as high up as the cheek is hollowed, bolts are driven through, about two feet six inches apart; these bolts are driven in a diagonal direction, so as to be on the fore edge of one cheek, and on the after edge of the other. The whole of the through bolts are clenched.

Upon Made Masts.

328. Made masts are in general composed of five principal pieces besides the cheeks; viz.

the spindle, the side trees, and fore and after fishes. These masts are formed by the several pieces that compose them, in the same manner as masts that are cheeked.

329. The spindle, which is the principal or main piece, extends from the head to a small distance below the wedges of the middle deck, in three deck ships, and upper deck in all others, if a piece can be provided long enough. It is the whole size of the mast, the fore and aft way, from the head to the first clasp hoop, where an abutment is sunk $1\frac{1}{2}$ inches, for the fore and after fishes; three feet below the abutment it is $\frac{8}{11}$ of the given diameter, and from thence to the lower end (where it is half the given diameter) it is straight. Athwartships, the spindle is at the head $\frac{6}{35}$; at the upper end of the side trees, or at the second clasp hoop, $\frac{7}{13}$ of the given diameter; and at the tongue or lower end $2\frac{1}{2}$ inches; between which places it is straight.

330. The side trees are brought upon the sides of the spindle; making up with the spindle, from its lower end upwards, the athwartship diameter of the mast; below the lower end of the spindle they meet at the middle line, and are of themselves, to the heel, the whole diameter athwartship; fore and aft ways, they conform to the size of the spindle, as far down as it extends; and below it they are parallel.

331. The fore and after fishes are brought on the fore and after sides of the mast, and extend from the heel up to the first or upper clasp hoop; they make up the fore and aft diameter of the mast, and are athwartships, as wide they can be obtained; the deficiency is made up by pieces called aris pieces.

To form and unite the several Pieces.

332. The spindle is worked with the butt end of the tree upwards. The middle line, or representative of the axis of the mast, is got upon the spindle, for setting off equally on each side the several diameters. And the length of the head for the stops, the hounds, and the place of the lower end of the cheeks, are determined the same as for single tree masts (318). Then to form it the athwartship way from the head (where it is $\frac{6}{35}$ of the given diameter (316), to the upper end of the side trees, which is at the second clasp hoop, its side is made to tend in a direct line to the diameter of the mast, at the lower end of the cheek, or to be $\frac{7}{13}$ at the second clasp hoop; and from this place it is drawn straight to the lower end, or tongue, when it is $2\frac{1}{2}$ inches. To form the spindle the fore and aft way, it is made to the whole size of the mast, from the head to 21 inches below the lower part of the hounds, which is the upper clasp hoop, and upper end of the fore and after fishes; this is obtained by setting off $\frac{3}{5}$ of the given diameter, at the head (316), and making it straight to the proportion at the third quarter, which is got by the graduating batten (317); at three feet below the first clasp hoop it is $\frac{11}{18}$ of the given diameter, from which place it is straight to the lower end, where it is $\frac{1}{2}$.

333. The side trees are worked with the butt end downwards; upon them are set off the upper and lower quarters (316), lower end of spindle, partners, and their whole length, as these pieces meet at the middle, and give the whole size of the mast, below the spindle; the middle line or axis for the athwartship way will be a line produced

from the joint or part where they meet; from this line for the outsides will be the given proportions as on the graduating battens, and from the lower end of the spindle to the upper end they are made straight, to half the size of the spindle from the middle line. The fore and aft way they are made to the size of the spindle this way, as far as it extends, and below it they are of the same breadth.

334. The fore and after fishes are worked with the butt end down, are brought on the fore and after part of the mast, and make up the fore and aft diameter. Accordingly the difference of the diameter will be that of the spindle taken from the whole diameters at the several quarters; and their proper thickness is obtained by setting off the partners and upper and lower quarters upon them, and as the side that fays to the side trees and spindle is straight to conform to these pieces, the difference is set off with the graduating batten, and outer parts of the fishes formed to it.

To unite the Pieces that compose the Made Mast.

335. The spindle when in two, which is frequently the case, is formed the fore-and-aft way, by the union of two pieces, at the athwartship middle line. These pieces are united together by circular coaks, at the middle line, about five feet apart, between the hooks (Note 69), and a bolt driven through each coak, which is left an inch and $\frac{1}{2}$ short at each end. The circular coaks diminish in size from 5 to $2\frac{1}{2}$ inches in diameter, as they approach the tongue.

336. The side trees are brought upon the spindle; they are coaked to the spindle with one

circular coak, about 9 inches above each hoop, placed alternately upon opposite edges or opposite sides, and bolted with one bolt through each coak, driven from the side on which the coak is placed; those above the tail of the cheek are rag-pointed, driven about once the substance of the side tree into the spindle; and those below are driven through.

337. The fore and after fishes are coaked to the mast with one circular coak under each hoop, and as far up as the substance of the side trees will admit; they are placed alternately in each, so as not to be nearer than their diameter from the edge of the fish; above, they are placed in the spindle, alternately on each side of the middle line, increasing in distance from it as the spindle widens. They are bolted with one rag-pointed bolt in each coak, driven rather more than the thickness of the fish into the side tree or spindle, according as they are placed. The aris pieces that make up the deficiency of the fishes are nailed with about two nails between each hoop.

To place the Hoops.

338. The hoops are placed, with one above and below each deck, where the mast is wedged; the one above with its middle 21 inches above the partners and the other two feet below, which places two hoops between each deck. Those below the decks, the lowest one with its lower edge about 16 inches above the heel; between this and the one below the lower deck, they are placed as near as possible to three feet apart. Above the decks one is placed about three inches below the

tail of the cheek, and the others between this and the one above the upper deck as near to three feet apart as they will space. The upper body hoop is placed 12 inches below the upper end of the side trees, and the intermediate ones between this and the one below the tail of the cheek, are likewise about three feet apart.

Upon the Cheeks to Made Masts.

339. The cheeks to made masts are formed the same as the cheeks to masts formed of a single tree (322), excepting to the larger masts, when they are sometimes formed in two at the middle, the fore-and-aft way; when this is the case, the two parts are united by circular coaks, in the head, one under every other hoop, and below, about five feet apart, decreasing in size in the thin part of the cheek, and bolted with bolts about five feet apart; where the cheek is hollowed they are short, and driven from alternate sides.

To space the Coaks and bolt the Cheeks.

340. The whole of the bolts and coaks are disposed as described in single tree masts cheeked (325), excepting those in the wake of the hounds; where there are six bolts and coaks, the coaks are placed so that each bolt shall pass through one, and are placed in alternate edges, on opposite sides, the two upper coaks within nine inches of the stops, the two lower about nine inches from the lower part of the hounds, the other two in the middle between them; the two upper bolts pass through an iron plate on each side, which plates are for giving support to the knees.

To space the Hoops upon the Cheeks.

341. The mast head hoops are spaced as explained in single tree masts cheeked (325). The joint hoops (Note 68) are placed, one fourteen inches from the lower end, and one 21 inches below the hounds, or over the butts of the fore and after fishes (334); the others are placed at equal distances between these, according to the size of the mast; from 28 to 35 inches in diameter, four; from 36 to 41 inches, five; and from 41 inches in diameter upwards, six; bringing them clear of the body hoops.

UPON THE FURNITURE CONNECTED WITH THE MASTS.

Upon the Crosstrees and Trestletrees.

342. Before the length of the crosstrees and trestletrees can be got, the size of the tops must be determined, which are in general $\frac{1}{3}$ the length of the topmast athwartships; and $\frac{2}{5}$ of their breadth fore and aft; but to obtain a greater spread to the topmast shrouds, they are frequently fanned (Note 70) from one to two feet on the after part, since breadthening them on the after part does not affect the bracing of the yards. The hole in the top is square, and made to $\frac{2}{5}$ the breadth. The trestletrees are in length $\frac{13}{14}$ of the top, or to reach to the overhang of the top rim; their depth $\frac{1}{8}$ of an inch in a foot of their length; and their breadth $\frac{2}{3}$ of their depth. They snape on the lower side from $\frac{1}{2}$ the depth of the trestletree down to 1 and $\frac{3}{4}$ of the depth in length, from the end, and 1 and $\frac{3}{7}$ of the

depth from the after end; the ends are rounded horizontally to a semicircle.

343. The crosstrees are in length $\frac{15}{16}$ of the top athwartships or extend to the overhang of the top rim; they are of the same breadth as the trestletrees, and their depth $\frac{2}{3}$ of their breadth, exclusive of the lubber wood (Note 70) which is left up from $1\frac{1}{2}$ to 2 inches, and its length the same as the square hole in the top. The crosstrees snape from $\frac{1}{2}$ their depth down to once their breadth from the lubber wood; they have their ends rounded horizontally to a semicircle.

344. The trestletrees, if more than 9 inches in breadth, have two strengthening bolts driven down about two inches from each side of each score for the cross-trees; if less than 9 inches, only one. The crosstrees, if more than 9 inches, have two bolts driven down about two inches from each end of the lubber wood, and two half inches without the score for the trestletrees; if less than 9 inches in breadth, they have only one at each of these places; they have likewise one strengthening bolt driven horizontally, just clear of the round; the whole of these bolts are saucer-headed and clenched. The trestletrees are faced upon the mast $\frac{1}{8}$ of their thickness, and are bolted with two bolts, which pass through both trestletrees, and are clenched.

Upon the Chock.

345. A chock is brought on the foreside of the mast between the trestletrees, and of the same depth. It is fore and aft half an inch to a foot of the given length of the mast head.

To space the Crosstrees.

346. The after edge of the foremost crosstree is placed once and $\frac{5}{32}$ of the diameter of the topmast, from the fore part of the chock; then the distance of the fore edge of the foremost crosstree to the after edge of the aftermost crosstree is equal to the square hole of the top. In letting down the crosstrees, the score is taken out $\frac{2}{3}$ of their depth from the trestletrees, and the remaining $\frac{1}{3}$ out of the crosstrees; they are always made to strengthen down a little for the ease of taking them out of their places, and replacing them at the mast head. When they are in their places, one saucer-headed bolt is driven through each, and forelocked on the under side of the trestletree.

Upon the Knees.

347. The knees are of elm, and in length $\frac{4}{5}$ the length of the hounds, in breadth the diameter of the topmast, before the fore part of the mast, and in thickness half the trestletrees; their sides are placed without a fore-and-aft line, so that the fore and outer edges may be well with the champher on the trestletrees (Note 72). The lower end lets in and forms an abutment within the champher of the hounds $\frac{1}{10}$ the size of the mast at that place; and a hook is likewise formed of the same depth at the middle of the knee; the upper part of the after edge is well with the fore part of the mast. The knees are bolted with three through bolts, and one rag-pointed bolt in the lower end. The through bolts pass through the hounds, and are clenched on the after part; one is placed just above the two upper hound bolts, and one just below the two

middle bolts, the other is placed in the middle between these two.

348. An iron plate is brought on each side of the mast to support the knees, extending from the champher on the aft part of the hounds, to within one inch of the fore part of the knee; it is placed at such an height, that the two upper hound bolts may pass through it. This plate is bolted to the knees with two bolts, which are driven through and clenched on the inside. An iron plate is likewise brought upon their upper ends and extends over the stops; this plate turns over the foreside of the knees about 4 inches, and has two short saucer-headed bolts driven into the foreside of the knees.

Upon the Bolster.

349. The bolsters extend from the fore part of the chock to the foreside of the after crosstree; they are of the same breadth as the trestletrees, so that they overhang what the trestletree is let in, and up and down one inch less; they are rounded from edge to edge. The bolsters are nailed with two nails driven into the trestletree, and considerably within the wood, to prevent their cutting the rigging.

Upon the Battens on the Mast Head.

350. The battens upon the mast heads have their lower ends well with the lower part of the lowest hoop, and extend two-fifths up the mast head, having their upper ends faying close to the mast, and snaped off, almost to a sharp, to prevent the

rigging from catching when getting it over. Singletree masts without cheeks have four, placed over the middle of the calf's tongue; all masts that are cheeked have eight, placed so as best to prevent the rigging from touching the hoops. The breadth of the battens are, to masts from 17 to 22 inches in diameter, $2\frac{1}{2}$ inches; from 22 to 30 inches, $3\frac{1}{2}$ inches; and from 30 inches in diameter upwards, 4 inches in breadth: and in thickness, $2\frac{1}{2}$ battens, 1 inch and $\frac{1}{4}$; and above $2\frac{1}{2}$ in breadth, 1 inch and $\frac{1}{2}$. The mast head battens are fastened with two nails between each hoop.

Upon the Rubbing Paunch.

351. The rubbing paunch is brought on the main and fore masts of ships and fore masts of brigs; it extends from the lower part of the chock between the trestletrees, to about 3 feet above the uppermost deck, or at a sufficient distance down for lowering the yards, to the lowest extent. It is worked with the butt end upwards, is in breadth $\frac{1}{3}$ the given diameter of the mast, and in thickness about 4 inches at each end; and in the middle so as to make the foreside straight. The rubbing paunch is fastened with nails, about two feet apart on alternate edges.

Upon the Tenons or Heeling of the Masts.

352. The tenons to main and fore masts are athwartships $\frac{3}{5}$, and fore and aft $\frac{2}{3}$ of the given diameter; and mizen masts $\frac{1}{3}$ athwartships, and $\frac{3}{5}$ fore and aft. The length of the tenon for all masts is six inches; they are $\frac{3}{8}$ of an inch smaller at the lower part than at the shoulder. In general a

shoulder $3\frac{1}{2}$ inches on and 8 inches up is taken on the fore and after sides of the masts, to receive a plate, for lifting the masts with the machine.

Upon Fishing the Mast.

353. When the mast is considered weak, or to give additional strength to single-tree mast cheeked, a fish is frequently brought on the fore side of the mast, called the front fish; when to a single-tree mast cheeked, the butt end of the tree is worked down, and it extends from the under side of the chock between the trestletrees, to about four feet below the first wedging deck; but to made masts, as it would be difficult to get a Riga or red pine stick to work of sufficient length to scarph with the deck, the fish extends from the chock between the trestletrees as far down as they can be conveniently got, in which case the butt end of the tree is worked upwards, because then the fish can be considered as giving strength to the mast only at the tail of the cheeks. These fishes are in breadth at the upper end the same as the spindle athwartships, at the tail of the cheek and at the deck, when the fish runs through, one inch more than half the given diameter of the mast, and at the lower end $\frac{3}{4}$ of an inch less; and in thickness at the upper end for sloops, $\frac{3}{4}$ less; and for frigates upwards, one inch and $\frac{1}{4}$ less than the chock between the trestletrees, that a rubbing paunch may be brought in to clear the yards of the clasp hoops, and at the same time that it may not interfere with striking the topmast, at the tail of the cheek, and two feet above the deck, when it runs through it, $\frac{1}{2}$ an inch less than half the breadth, and at the lower end one inch and $\frac{1}{4}$ less

than half the breadth, that the hoops at the lower end may be easily driven on.

354. The front fish is coaked to the mast by a chain of coaks raised from the round of the mast, commencing as far down as there is sufficient round to raise them; the midship edge of these coaks is well with the middle line of the mast, excepting the upper and lower one, which are placed at the middle. The coaks are about three feet in length, from one inch to one inch and quarter in thickness, and in breadth $\frac{1}{4}$ the breadth of the fish, with their edges alternately $\frac{1}{4}$ from the edge of the fish. These fishes are fastened with rag-pointed bolts, placed two feet apart on alternate edges.

Upon Hooping the Front Fish.

355. The hoops as far down as the cheeks extend, are placed the same as those upon the cheeks (341), as they answer for hooping both, with a chock placed between the edge of the cheek and fish under each hoop; but the cheeks, instead of having the margin of the fore edge the same as the after edge as before explained (324), have their fore edges left at the hounds $\frac{1}{2}$ an inch more than half their thickness, and at the lower end $\frac{2}{3}$ their thickness. The hoops below, when the fish scarphs the deck, are placed one about two feet above the deck, and one about five feet below this hoop; these two hoops are in general driven on; the remaining hoops, which are clasp hoops, between the hoop above the deck and the one at the tail of the cheek, are placed, so as to be at equal distances of about five feet. A chock is placed under each hoop so as to make a fair curve

with the fore side of the fish and round of the mast; these chocks are 18 inches in length, and have their upper ends snaped off 5 inches down, to prevent the water lodging on them. In the wake of the deck, instead of having a chock under the hoops, an ekeing is worked on each side of the fish, of the same form as the chock, to extend from the lower end to about two feet six inches above the deck, for the convenience of wedging the mast.

356. When the fish is short of the deck, one hoop is placed about 14 inches from the lower end, and the remaining hoops between this and the one at the tail of the cheek, are placed at equal distances of about five feet; the whole of the hoops are then made to clasp.

Upon the Masts of Cutters and Schooners.

357. These masts have their lengths in general given for the heading and hounding, and are formed the same as single-tree masts without cheeks (318), except that their heads are in general rounded, and the proportion for the hounds or stops varies from $\frac{3}{4}$ to $\frac{6}{7}$ of the given diameter; and on the fore side, at the hounds, a stop is formed from $\frac{3}{4}$ to one inch for the support of the lower cap. It is the case sometimes that the heads of these masts are formed $\frac{3}{4}$ of an inch larger the fore-and-aft way than the athwartship, to give additional strength in acting against the gaff, &c.

Upon the Hounds Pieces.

358. The hounds pieces are formed, coaked, and fastened to the mast the same as to single tree masts (319), but their length is only $\frac{1}{5}$ the length of

the mast head to give more hoist to the gaff; and to prevent the jaws from catching, in case the peek halliards are let go, before the main halliards are settled, the hounds pieces are brought nearly to the aft side of the mast, and rounded off with it.

To Hoop the Mast.

359. The lower hoop on the mast head is placed to receive the eye for the main halliards, which is from two feet to two feet eight inches above the lower side of the lower cap. This hoop is in general formed with a wide collar, to receive the shoulder that is formed in the bolt, for giving support in resisting the strain downwards; the upper hoop is placed with its upper edge about six inches below the upper cap, and three others are placed at equal distances between this and the lower one. The four upper hoops have an eye bolt to pass through them from the aft side of the mast, and clenched on the foreside, for the peek halliards; their eyes lie horizontally; those in the upper and lower hoops are placed in the middle line of the mast, and those through the two intermediate ones 1 inch and $\frac{1}{2}$ on each side the middle. One hoop is driven on the lower end, about 6 inches above the shoulder of the tenon.

Upon the Caps fixed on the Masts of Cutters or Schooners.

360. Cutters and schooners have in general two caps; one fixed upon the stops for receiving the lower end of the topmast, and is called the lower cap, and is made to answer as trestletrees, for securing the crosstrees or stretcher to; and one fixed upon the mast head, called the upper cap, which is in general of iron.

Upon the Lower Cap.

361. The lower cap is in length twice and $\frac{3}{4}$ the diameter of the topmast and the diameter of the mast head at the stops; the breadth is three diameters of the topmast, and the depth $\frac{1}{5}$ of its breadth. The cap is made to clasp the mast, and to extend abaft it $\frac{7}{12}$ the diameter of the topmast, or so as to receive the after crosstree. The fore part of the hole for the topmast is placed $\frac{3}{4}$ of an inch more than $\frac{7}{12}$ the diameter of the topmast from the fore end, or so that one half the diameter of the topmast may be left between the after part of the hole and the fore part of the mast. The fore part of the cap is rounded to a semicircle, and an iron plate is made to clasp it, and to extend as far aft as the fore part of the mast. Through this plate a bolt is driven, which passes through the middle of the short wood left between the after part of the hole for the topmast, and fore part of the mast. This plate, which is in breadth $\frac{2}{3}$ the depth of the cap, is let in, so as to be fair with the outside, and frequently to make the cap lighter, it is reduced in breadth one inch and a half on each side, from the fore part of the mast forward.

362. From the under side of the cap, two eye-bolts are driven, with their eyes lying athwartships, in the middle, between the hole and the outside of the cap, and immediately opposite the middle of the hole for the topmast. These bolts are clenched on the upper side upon plates. The cap is bolted in general with two bolts that pass through the mast; and that the cap may have a proper bearing where the bolts pass through, the stops are continued to the upper part of the cap, and formed on the fore side to an eight-square, and on the aft

side square, so as to form a tangent to the round of the mast above the stops.

Upon the Upper Cap.

363. The upper cap is in depth about $\frac{7}{12}$ the diameter of the topmast. The part that lets on the mast head is square, with a small portion of the angles taken off, and of such size as to be inscribed within the circumference of the mast head. The fore part is a circle, placed so that the topmast may lie parallel to the mast head. The iron that unites the two parts is formed square, and half the diameter of the topmast. Two eyes are frequently placed on the outside of the round part of the cap, one on the fore and one on the after quarter, or so as to form an angle of 45° with a fore-and-aft line; but it is found more convenient to do away with one of these eyes, and to have a shive-hole, to the same angle, through the mast head, with its upper part about two inches below the upper hoop.

Upon the Stretchers or Crosstrees.

364. The crosstrees are in length $\frac{1}{3}$ the length of the topmast, in breadth $\frac{7}{12}$ the diameter of the topmast, and in depth $\frac{5}{7}$ of their breadth; they are tapered from $\frac{1}{8}$ their length on each side the middle, reducing their depth at the ends, from the lower side, to $\frac{3}{5}$ of the middle, and their breadth at the ends, from the fore side of the after, and aft side of the fore, to $\frac{6}{7}$ of the middle; their ends are rounded off to a semicircle. The crosstrees have no score taken out of them, but let down on the cap about $\frac{1}{6}$ of their depth, and are bolted with two saucer-headed bolts that forelock on the under side of the cap.

Upon the Bolster.

365. A bolster is fitted on the upper part of the cap which extends from the fore side of the after crosstree to the after part of the topmast.

Upon Bowsprits.

366. Bowsprits are single-tree or made. The part that rests upon the stem and apron, from the fore part of the stem to the after part of the apron, is called the bed; from the outer part of the bed to the heel is called the scarph or housing, and $\frac{1}{9}$ the given length in from the outer end, is called the bee's seating or head.

Upon Single-tree Bowsprits.

367. Single-tree bowsprits have the top end of the tree worked outwards. The given length of the bowsprit is from the fore part of the tenon for the cap to the after part of the tenon at the heel; from the heel the length of the scarph is set off for the outer part of the bed, and within this distance, the length of the bed where the bowsprit is parallel, and in diameter equal to the given diameter; from the outer part of the bed to the outer end, the bowsprit is divided into four equal parts for the outer quarters, and from the inner part of the bed to the inner end, into four parts for the inner quarters. The outer end is $\frac{3}{5}$ and inner end $\frac{5}{6}$ of the given diameter, and graduated between each end and the bed according to the common method (317).

368. Bowsprits are made round their whole length, excepting on the upper part at the outer

end, where they are left square $\frac{1}{9}$ the given length to receive the bees. The round on the lower part at the outer end, is carried up to the upper angle of the lower eight square, and the square is brought into the round by a hance about $\frac{1}{4}$ the length of the head.

To Hoop a Single-tree Bowsprit.

369. Single-tree bowsprits have in general one hoop driven on two feet four inches from the heel, and one clasp hoop is placed just within the hance. Should the head or heel be shaky, or the body of the bowsprit knotty, additional hoops are added; to the head, one about two feet four inches in; to the heel, one or two, as may be necessary, and upon the body, one over each bad knot.

Upon a Made Bowsprit.

370. Made bowsprits have the same length of head, are formed at the bed, and are of the same proportions at the head and heel as bowsprits formed of a single tree; they are composed of four principal pieces, two called the upper and lower trees, or main pieces, and the two side fishes. The upper and lower trees are united at the middle, and when together make the diameter of the bowsprit up-and-down; athwartships these pieces are at the outer end, the diameter of the jib boom, and at the bed, half the given diameter of the bowsprit; and from this place to the inner end they are parallel. The side fishes are the difference of thickness between the upper and lower trees, and the whole diameter of the bowsprit; they therefore make up the athwartship diameter.

371. The upper and lower trees are coaked together at the middle, and have the butt end of the tree worked inwards. When they are together, the side fishes are coaked to them, with their butt ends likewise inwards.

To Coak and fasten the several Pieces of the Bowsprit.

372. The upper and lower trees have one coak under each hoop on each side of the middle line, and one through bolt in every coak; and the side fishes are coaked between each hoop, in each main piece alternately, and have one rag-pointed bolt through each coak, driven about the substance of the fish into each main piece.

To Hoop the Made Bowsprit.

373. Made bowsprits have two hoops upon the head, one about two feet four inches in, or so as to be three inches clear of the aft side of the cap, at the lower side of the bowsprit. The other so that there shall be half the length of head between them. The next hoop in, which is a clasp hoop, is placed with its centre three feet from the center of the inner head hoop. One hoop is placed about three inches without and one three inches within the bed, and one two feet four inches from the heel. The intermediate hoops are placed, both upon the inner and outer part of the bowsprit, as near as they will space to three feet from centre to centre.

UPON THE FURNITURE CONNECTED WITH THE BOWSPRIT.

Upon the Bees.

374. The bees are in length from the aft side of the cap to the fore part of the hance; in breadth $\frac{1}{2}$ the given diameter of the bowsprit, and in thickness $\frac{1}{4}$ their breadth at the edge close to the bowsprit, but $\frac{1}{4}$ their thickness less than this at the outer edge. Their upper side, to coincide with the upper part of the bowsprit at the inner edge, and to stand up from a level their thickness and one inch. The after and outer corners are rounded to an arc of a circle, of such a radius that the after end may be a tangent to it at $\frac{1}{3}$ in from the outer edge.

375. The bees are bolted with 3 through bolts, and clenched upon the opposite side of the bowsprit, with the after one placed so as just to clear the fore side of the after head hoop, the foremost one four inches from the fore end, the other in the middle between these two (Note 73).

Upon the Bee Blocks.

376. The bee blocks are placed, one on each side of the bowsprit, close under the bees. They are in length upon the upper part half the length of the bees, their depth $\frac{1}{3}$ their length, and their thickness twice the thickness of the shive. The foremost one is placed on the starboard side, and abutts against the cap, and has the fore end rounded off what it projects beyond the cap, making the fore part of the shive hole well with the aft side of the foremost head hoop. The larboard block is placed with its fore end in the same athwartship line with

the after part of the shive hole of the starboard block. They have a small round taken off their after and outer corner.

377. The blocks are bolted with two bolts in each. The after bolt in the starboard is made to answer for the foremost bolt of the larboard.

Saddle for the Jib Boom.

378. The saddle for the jib boom is placed with its after part $\frac{1}{3}$ the length of the jib boom from the fore part of the cap; it is in length $\frac{1}{2}$ the diameter of the bowsprit; its width is $\frac{1}{2}$ the diameter of the jib boom, and in thickness so that the jib boom may lie parallel with the middle line of the bowsprit. It is fastened with one rag-pointed bolt in the middle, and a nail in each end.

Cleat for the Slings of the Spritsail Yard.

379. The cleat is placed with its fore side $\frac{1}{5}$ the length of the bowsprit from the outer end; it is in length the diameter of the jib boom, in thickness $\frac{1}{3}$ of its length. It is formed with its fore and after sides to a vertical line, and its upper part is rounded, and of such an height, that the jib boom may lie upon the saddle clear of it. The cleat is fastened with two nails; and to prevent the slings from rubbing the upper part of the bowsprit, a piece of lead is nailed upon the bowsprit under the cleat, to extend down about two inches below the middle line, and in breadth $\frac{1}{2}$ the diameter of the bowsprit; and a piece of copper is likewise continued round the under side, to prevent the yard from injuring it.

To heel the Bowsprit or form the Tenon.

380. The tenon of the heel of the bowsprit is, up and down $\frac{3}{5}$, and athwartship $\frac{1}{3}$ of the given diameter, and in length one inch and $\frac{1}{2}$ more than the thickness of the partners. Sideways, the tenon is made to taper $\frac{3}{8}$ of an inch; but up and down, to have the lower part on a level, and the upper part in the direction of the bowsprit. The sides and upper part form their shoulders against the partners; but the lower part is taken through in the direction of the tenon.

Upon the Bowsprit of Cutters.

381. Cutters' bowsprits are formed for the given diameter, to be $\frac{1}{3}$ from the inner end within which they are made parallel, and the outer end is made $\frac{2}{3}$ of the given diameter; from the inner end, as far as the bowsprit reefs, it is made square, with a champher taken off the angles, from one inch and $\frac{1}{2}$ to two inches and $\frac{1}{2}$; and from the termination of the square part to the outer end it is made round. The square is formed into the round, by a hance in length about $\frac{3}{4}$ the diameter of the bowsprit.

382. Upon the outer end of these bowsprits a hoop is let on, with four eye bolts in it, one upon the top, one at the bottom, and one on each side; six inches within this hoop a shive hole is cut up and down, from one inch and $\frac{3}{4}$ to two inches and $\frac{1}{2}$, for the jib outhaul; and at the inner end a shive hole is cut, lying horizontally, for bowsing the bowsprit out; this shive hole is mouthed quite to the end for unshipping the rope.

383. The reef holes are in general from three to four in number, and are at a distance from

each other, from the inner part to inner part, from two feet four inches to two feet six inches, otherwise they are made to conform to the different sizes of the jibs. The holes are formed for a square fid, or round, to receive a bolt; when square, they are $\frac{1}{3}$ the diameter of the bowsprit in the direction of its length, and $\frac{2}{3}$ this size up and down; when round, they are of iron.

UPON THE CAPS TO THE LOWER MASTS AND BOWSPRIT.

Caps upon the Lower Masts.

384. The caps upon the lower masts are mostly of elm, and in breadth twice, and in thickness $\frac{5}{6}$ the diameter of the topmast. The hole for the topmast is sweept to once the diameter, $\frac{3}{4}$ of an inch for the thickness of the leather, and $\frac{1}{8}$ of an inch for play, and its forepart is placed once the depth of the cap from the fore end; from the after part of this hole, to the fore part of the square hole, is half the taper of the mast head and the thickness of the chock between the trestletrees, this hole is $\frac{9}{10}$ fore and aft, and $\frac{8}{10}$ athwartships of the size of the mast head; the fore part and two sides of the hole, are made $\frac{3}{4}$ of an inch in a foot towards the upper part, on or from a perpendicular to their under side, or what is technically made to strengthen down $\frac{3}{4}$ of an inch to a foot; and the after part is square, or made perpendicular through. The wood left beyond the after part of the square hole is equal to the depth of the cap; the four corners of the cap are rounded off to a circle, letting the ends and side be a tangent to it, and the radius $\frac{1}{5}$ the breadth of the cap.

385. The caps when made of two pieces are united at the middle, and have three circular coaks

of $3\frac{1}{2}$ inches in diameter, one placed in the middle between the holes, and one at each end about the middle, between the holes and the extremities.

386. Caps, whether made or in one piece, have horizontal strengthening bolts driven through them and clenched; caps to masts below 32 inches in diameter have six; caps to masts 32 inches in diameter, and all above, have eight bolts. These bolts are placed, for two to pass between the two holes; and if only six, two between the holes and ends, in the same vertical line; but if eight bolts, three are placed at each end, two about $2\frac{1}{2}$ inches from the holes, and one between these and the end of the cap, in the middle up and down. The whole of the bolts that are placed in the same vertical line, are $\frac{1}{4}$ the depth of the cap from the edges.

387. These caps have four eye-bolts driven from the under side, with their eyes athwartships and clenched, upon plates, on the upper part; two are placed in the same athwartship line, with the centre of the square hole, and two with the centres in the same athwartship line as the fore part of the round hole. Fore and aft they are placed in the middle, between the side of the holes and the side of the caps. The two eye bolts that are opposite to the square hole, have their eyes placed on one side of the cylindrical part of the bolt, in room of the centre, that the blocks may the better clear the mast head.

Bowsprit Cap.

388. The bowsprit caps are twice the diameter of the jib boom in breadth, and $\frac{5}{6}$ its diameter

in thickness. The upper end of the cap fore-and-aft is formed to the angle made by the stive of the bowsprit and a vertical line; or as the cap is placed vertically in the direction of the stive, below the upper end in the direction of the cap, its thickness is set down, and a line drawn through parallel to the upper end, which is the station and direction of the upper part of the hole for the jib boom; below this line another is drawn parallel to it, and at a distance, set off perpendicular to the stive, equal to the diameter of the jib boom, and $\frac{3}{8}$ of an inch for play; this will give the lower part of the hole for the jib boom. These lines are drawn across the fore and after sides of the cap perpendicular to the edges, and will give the size of the hole up and down, in the direction of the cap; and as the hole will be an ellipse, on account of the stive, the distance between them will be the major diameter, while if two lines are drawn (an inch and $\frac{1}{2}$ nearer the larboard than the starboard side, to allow more room for the jack stave) parallel to the edge and equal to the diameter of the jib boom, and $\frac{3}{8}$ of an inch for play, it will give the minor diameter; to these diameters an ellipse must be described for the hole. To obtain the square hole, a distance is set off, in the direction of the cap, equal to $\frac{6}{10}$ of the diameter of the jib boom, and to it a line is drawn across the aft side, perpendicular to the edge; this line will coincide with the upper side of the bowsprit, and give the upper part of the square hole on the aft side; a line is drawn to correspond with it upon the edge parallel to the lines before drawn; then on the fore part of the cap, $\frac{1}{16}$ of its thickness is set down perpendicular to the stive, for what the cap is to strengthen on; this will give the upper part of the square hole on the fore side. From the upper part on the

fore side perpendicular to the stive, $\frac{1}{6}$ the diameter of the outer end of the bowsprit is set down, and a line drawn on the edge in the direction of the stive, to correspond with which, lines are drawn perpendicular to the edge for the fore and aft sides; these lines will give the lower part of the square hole on the fore and after parts of the cap. Below the lower part of the square hole, the thickness of the cap is set down in the direction of the cap for the lower end, which is formed parallel to the stive; the square hole is made athwartships on the aft side $\frac{1}{4}$ an inch less than the diameter of the jib boom, and on the fore side $\frac{1}{16}$ the thickness of the cap less than the aft side for strengthening on.

389. The bowsprit cap has six strengthening bolts driven thro' it and clenched; four of which are eye bolts, with their eyes in the direction of the stive, two are placed in the middle between the upper part of the round hole and the upper end, and two between the round and square hole. These eye bolts are driven, one of the upper and one of the lower, from one side, and the other two from the opposite side; the remaining two bolts are placed in the middle, between the lower part of the square hole and lower end; the whole of these bolts are placed $\frac{1}{4}$ the thickness of the cap from the edges.

390. An eye bolt with its eye up-and-down in the middle line, upon the side, at the lower end of the cap; it is brought through upon the upper side of the bowsprit, and fore-locked just abaft the after edge of the foremost hoop. This bolt is for fastening the cap on and for a guy for the spritsail yard.

Upon the Topmasts.

391. Topmasts have their lengths given the same as the standing masts (318); and have the lengths of the head, and additional length of head, formed from the given length as these masts. From the lower end six inches is set up for a hoop, and from this distance the given length, and beyond it $\frac{1}{36}$ for an additional length of head; then the whole length of the head or to the stops, is made $\frac{5}{36}$ the given length of the mast, and from the lower end the length of the lower mast head for the place of the cap, or place of the given diameter.

392. From the cap to the stops the mast is quartered and graduated (317), and below the cap it is made parallel to the given diameter, graduating to $\frac{3}{4}$ at the stops for the body (314); but to give additional strength at the head, the topmast is made at the stops $\frac{9}{14}$ athwartships and $\frac{9}{13}$ fore and aft, forming it with the body of the topmast at the lower part of the hounds, the length of which is $\frac{1}{8}$ of the given length, or $\frac{1}{2}$ the given head. At the head the topmast is $\frac{5}{9}$ of the given diameter.

393. The fore and after stops are formed to $\frac{1}{6}$ the size at that place, or as large as the topmast will go through the lower cap, and on each side hounds pieces are in general brought on; and for raising two coaks, one inch and $\frac{1}{8}$ wood is left from the stops to $\frac{1}{2}$ the length of the hounds down, and from thence is brought into the size of the topmast at the lower part of the hounds; but when the stops are worked out of the mast, they are left for their outer parts to be the size of the

topmast at the second quarter, or as large as possible to allow them to go through the cap.

394. The topmast is rounded from the lower part of the hounds to one diameter below the given mast head; from hence it is eight-squared to $2\frac{1}{2}$ diameters above the upper part of the hoop, where it is left square for the heeling, excepting that a champher is taken off from each angle, to $\frac{1}{5}$ the diameter; the hounds have likewise a champher taken off at the stops from each angle, to $\frac{1}{5}$ the size of the stops, which is brought to the size of the eight square at the lower part of the hounds. The head is square above the stops, with about $\frac{3}{4}$ of an inch champher taken off the angles.

Upon the Hounds Pieces.

395. The hounds pieces are of elm, in length $\frac{1}{18}$ of the given length, or $\frac{1}{2}$ the given mast head, in breadth as much as the surface they are to fay upon, and in thickness so that the topmast may pass through the cap. They have two square coaks raised in each, from one inch to one inch $\frac{1}{8}$; the lower one is placed with its lower end $\frac{1}{2}$ the hounds down, where an abutment is left the whole breadth between the champhers, by the lower end of the lower coak being flush with the faying surface; the coaks are $\frac{1}{3}$ the breadth of the hounds pieces; the upper one is $4\frac{1}{2}$ inches down from the stops, and 6 inches in length; the space between the coaks, which is 3 inches, determines the length of the lower one. The outer sides of the hounds pieces are round, that they may have the greatest possible substance in the middle, and pass through the cap.

396. The hounds pieces are bolted with three bolts, two just above the upper coak, and one in the middle between the two coaks; from the middle down they are fastened with nails, two inches from the edge, and three inches apart; they are likewise placed round the end which is rounded off.

Upon the Heeling.

397. The heeling is brought on each side and upon the fore part; upon the sides so as to fill up between the trestletrees, and on the fore part so as to fill up between the chock and the crosstree, except $\frac{1}{4}$ of an inch play. The heeling is in length 3 diameters, and in breadth $\frac{3}{5}$ of the diameter; but as the champher is in general brought into the size of the eight square, at 3 diameters, commencing at $2\frac{1}{2}$ diameters, the heeling must necessarily taper from $2\frac{1}{2}$ diameters to the breadth of the eight square at three diameters. The heeling is likewise tapered flatways from the middle of the length, to about $\frac{1}{2}$ an inch at the upper end. The heeling is fastened with nails.

Upon the Shives.

398. There are two shives in the lower part of the topmast; when there is no block left below the trestletrees, which is quite unnecessary, as only adding to the length of the tree required for it, there is only a half shive placed in the lower end, with its upper part half the diameter of the topmast and the thickness of the shive above the hoop. But when there is a whole shive, the topmast is left for a block once and $\frac{1}{2}$ the diameter of the top-

mast below the lower part of the trestletrees, which is in addition to the given length. This block is eight squared, with a hoop on the lower end, and has a shive hole on the larboard foreside eight-square, in length once the diameter of the topmast and $\frac{1}{6}$.

399. The upper shive is placed upon the opposite eight square to the lower one, that is to pass through from the starboard fore side eight-square to the larboard aft side, and its lower part 3 diameters above the upper edge of the hoop, when no block, or lower side of the trestletrees; its length is once the diameter of the topmast and $\frac{1}{6}$. From the lower shive to about $3\frac{1}{2}$ diameters there is a groove taken out, rather larger than the top rope for it to lead fair.

Upon the Fid Hole.

400. The lower part of the fid-hole is placed, once the depth of the trestletrees above the upper part of the hoop and one inch, for an iron plate that is brought on the trestletrees; it is up and down, if wood $\frac{1}{2}$ and if iron $\frac{1}{3}$ the given diameter of the topmast, and its width $\frac{2}{3}$ of what it is up and down. The fid-hole is made up and down $\frac{3}{4}$ of an inch more than the proportion given, for an iron plate, which is fixed on the upper part, turning up on each side $\frac{1}{2}$ the depth of the hole. This plate is nailed with two nails on each side.

Upon the Cheek Blocks.

401. The cheek blocks are placed on each side, upon the head of the topmast, with their

upper ends about 2 inches below the lower side of the cap; their length is once and $\frac{1}{2}$ the given diameter, breadth $\frac{4}{5}$ the head of the topmast, and thickness twice the thickness of the shive; when there are two shives in the block, $\frac{1}{9}$ is left at each end beyond the shive, and $\frac{1}{9}$ between the shives; when there is but one shive, which is in general the case to the main-mast, the block is $\frac{3}{9}$ shorter than the proportion given; on each end and in the middle between the shives, a coak is raised $\frac{3}{4}$ of an inch, and let into the topmast for a steadiment for the block. The blocks are fastened only by the two pins for the shives, which pass through the two blocks and are forelocked.

Topmast Cap.

402. The cap is the same in proportion to the topgallant mast as the lower caps are to the topmast (384), and have their holes formed and are let on the same. They have four eyebolts placed with their eyes athwartships, two about the after part, and two about the fore part of the round hole; and six strengthening bolts, two at each end, and two in the middle, between the holes placed as described for the lower caps.

Upon the Topmast Crosstrees.

403. The topmast crosstrees and trestletrees are united together, and got into their position, upon the topmast, in a frame. This frame is in general composed of two trestletrees, similar to those connected to the lower mast, two or three long crosstrees; if only two, a short crosstree is placed to form a frame round the topmast; and

one short crosstree with its aft side the diameter of the topgallant mast and heeling before the foreside of the long crosstree.

404. The trestletrees are in length $\frac{3}{9}$ of the given length of the topgallant mast, the crosstrees twice the length of the trestletrees; the after one is in general one foot longer than the foremost one. The trestletrees are deep $\frac{5}{44}$ of their length, and wide $\frac{5}{9}$ their depth; the crosstrees are wide once the width of the trestletrees, and deep, at the middle, $\frac{8}{9}$ their width, and at the ends $\frac{1}{2}$ the depth of the middle; they are of a parallel depth, at the middle, to $\frac{1}{3}$ of their length. The trestletrees are snaped from $\frac{1}{2}$ their depth down to $\frac{1}{2}$ their depth from the end, and their ends rounded the same as those to the lower mast (342), and the crosstrees have their ends rounded to a semicircle, and a hole bored about three inches in, for the topgallant shrouds; though sometimes a score is taken out, and a small roll fitted in for the ease of unshipping them. The short crosstrees, when fixed, extend beyond the outside of the trestletrees as much as the trestletrees are wide, and have their ends rounded to a semicircle. The trestletrees are kept apart $\frac{9}{14}$ the diameter of the topmast, or the size of the topmast athwartships, above the stops, and are placed so that the middle of their length, when fixed, may be well with the centre of the topmast. The crosstrees are fixed to the trestletrees, for the foremost, long, and middle crosstree to be equally on each side of the centre, and to be apart $\frac{9}{13}$ the diameter of the topmast, or the size of the topmast fore and aft above the stops. The foremost short crosstree is placed with its aft side the diameter of the topgallant mast and the heeling, before the

fore side of the foremost long; and the after crosstree is placed at the same distance abaft the crosstree, that is fixed on the aft side of the topmast, that should it be required, the topgallant mast may be fixed on the aft side as well as the fore side of the topmast. The crosstrees are let down into the trestletrees $\frac{2}{5}$ of their depth, and the score is taken $\frac{2}{3}$ out of the trestletrees, and $\frac{1}{3}$ out of the crosstrees of what they let down. A facing is taken out of the trestletrees from $\frac{3}{4}$ to one inch to receive the crosstrees.

405. A chock is let up immediately under the crosstree, to the one before, and to the one abaft the topmast; they are in depth from the under side of the crosstrees to the lower part of the trestletrees, and as wide as the crosstrees. These chocks are let into the trestletrees from $\frac{3}{4}$ to one inch.

406. An iron plate is brought on the lower side of the trestletrees and across the chocks between them (405), so as to circumscribe the hole for the topmast. This plate has the part where it lies upon the trestletrees, of the same width as the trestletrees; and where it lies upon the chock, the same breadth as the chock. The crosstrees have one saucer-headed bolt in each trestletree, which forelocks on the under side; those that pass through the crosstree, that are placed on each side of the topmast, are forelocked on the under side of the plate, and form its fastening.

407. A bolster is placed for the rigging upon the upper part of the cross and trestletrees, it extends from the fore part of the foremost to

the after part of the aftermost crosstrees, that are placed on the fore and after sides of the topmast; these bolsters are one inch wider than the trestletrees, and deep $\frac{6}{7}$ of their width; they are fastened with two nails into the trestletree, driven considerably within the wood.

Upon a Lengthened Topmast.

408. Made or lengthened topmasts are sometimes used for ships of the line in order to bring into use such sticks, or trees that could not otherwise be made to answer for these classes of ships; as by forming them at the heel by several pieces, and shortening the main piece, the crooked or knotty tops may be cut off. These topmasts have a lengthening piece brought on their heel 8 inches square, and from 9 to 10 feet in length, as the stick may require; this piece tenons into the heel, and has the diagonals lying athwartships, and fore and aft, or its four sides parallel to the eight squares on the quarters; the lower end of the topmast is formed to the size of this piece, preserving the cylindrical form of the topmast, three feet below the cap or $\frac{1}{3}$ the length of the scarph.

409. To form the lower part of the topmast, four pieces are brought on, with their joints lying fore and aft, and athwartships, extending within about two inches of the lower side of the cap to the heel, faying upon the lengthening piece and upon the lower end of the topmast; these pieces are to topmast of 18 inches in diameter, 12 inches square, and to topmast of 21 inches in diameter, 13 inches square; they are made at the upper end with a lip

of an inch and $\frac{1}{4}$ in thickness, and at the lower end to the full size, to give a good drift for the hoops.

410. These topmasts have six inches allowed at the lower end for a hoop, and beyond that $\frac{1}{2}$ the diameter, and about $\frac{1}{6}$ for the half shive; then from this distance the length is set off as for the common topmasts, and above the cap it is formed the same; but, below, the pieces brought on are rounded from one diameter, and $\frac{1}{2}$ above the upper part of the half shive, or place where the length is set off from; below it is square, except a champher is taken off to $\frac{1}{6}$. The fid hole and whole shive is placed the same as to the common topmast.

To space the Hoops, Coaks, and Bolts.

411. There is one hoop placed upon the heel as to all other topmasts, called the heel hoop; one is placed six inches from the upper end of the four pieces, and one six inches above the butt of the lengthening piece; there is one likewise placed at the lower part of the round, and one a foot below the butt of the lengthening piece. In two of the pieces that are opposite, there is one circular coak placed under each, into the lengthening pieces, or topmast, according as the hoop comes over; in the other two, they are placed about six inches above the hoop; below the hoops, in two of the pieces that are opposite, and have not the coak under the lower hoop, one coak is placed in each, in the middle between the fid hole and lower hoop; one is likewise placed in each of the two opposite pieces, just above the half shive, and in the other two in the middle, between this, and the fid hole,

To the third hoop down, a rag-pointed bolt is driven through each circular coak, below which, a through bolt is driven through each circular coak, and its opposite.

Upon Topgallant Masts.

412. Topgallant masts are in general made with the topgallant and royal in one. They are sometimes however fitted with stump poles, when they frequently have a sliding gunter mast fitted to them; and in others they are fitted with fidded royal masts. When the royal and topgallant are in one, the given length is set off from the lower end; and from that length is set back $\frac{7}{72}$ for the stops, then from the whole length, half the given length is set beyond it, for the royal stops. This proportion for the length of the royal pole is frequently departed from, and the whole length is made to vary from $\frac{9}{13}$ to $\frac{4}{5}$ of the given length; and they are sometimes extended to $\frac{1}{3}$ and 10 feet, but this gives the pole considerably too long for small vessels: beyond the royal stops $\frac{7}{33}$ of the given length is set off for the skysail or signal pole. From the lower end the station of the cap is set off for the place of the given diameter; and from this distance to the topgallant stops, where it is $\frac{10}{13}$, and from the topgallant stops to the extremity of the signal skysail pole, where it is half the given diameter (or if no skysail pole, $\frac{3}{5}$ at the royal pole), the mast is quartered and graduated, without regarding the stops. The topgallant stops are in length twice, and the royal stops once and a half the given diameter, and project so as to be the size of the second quarter of their respective masts or poles. The

stops are eight squared. And the topgallant mast is rounded from two diameters below the upper part of the cap to the lower part of the stops; the royal is rounded from one diameter above the topgallant stops, where it is left square in case of jacks being fitted for supporting the royal, excepting a champher is taken off to conform to the eight square of the stops, to the lower part of the royal stops; the signal pole is rounded from the stops to the extremity. The topgallant mast is eight squared from two diameters below the upper part of the cap to three diameters above the lower end, and from thence downwards it is left square, except that a champher of $\frac{1}{6}$ is taken on each way to $2\frac{1}{2}$ diameters up, from which place it is formed into the eight square.

Upon the Heeling.

413. The heeling is brought on the two sides and fore side so as to conform to the space between the cross and trestletrees; and is the same to the topgallant mast as explained for the topmast (397).

Upon the Fid Hole.

414. The lower part of the fid hole is one diameter and one inch up from the lower end; it is up and down half the given diameter, and athwartship $\frac{2}{3}$ of what it is up and down.

Upon the Shive Holes.

415. There is one shive hole placed in the starboard foremost eight-square, with its lower

part three diameters from the lower end, and its length one diameter and $\frac{1}{6}$; and another shive is placed in a fore and aft direction, half the diameter below each of the stops; these shives are in length the diameter of the stops and $\frac{1}{6}$, and are coppered.

Upon Stump-pole Topgallant Masts.

416. Stump-pole topgallant masts have their length set off and are formed the same as the topgallant mast and royal in one, excepting that $\frac{7}{36}$ only, or two heads, is set beyond the given length, and $\frac{7}{72}$, or one head, back for the stops, which makes the pole three heads above the stops. The diameter of the extreme end of the pole is half the given diameter.

Upon Fidded Royal Masts.

417. Topgallant masts for fidded royal masts are the same as topgallant masts with the royal in one, excepting that the head and additional length of head is set off the same as for topmasts (391), and of the same proportions for the diameters.

Upon the Yards.

418. Yards are either square or lateen; square, when they are placed at right angles to the mast, and lateen when oblique; yards have two distinguishing parts, the slings and the yard arm; the slings to square yards are always in the middle, to lateen in general at a certain proportion from the middle. The yard arms are at the extremities of the yards.

419. The place of the given diameter of yards is at the slings; the yard arm always bears a certain proportion to the slings, according to the nature of the yard; and the yard is quartered from the slings to the yard arm, and which are distinguished thus, 1st, 2d, 3d, and yard arm. The proportion for the quarters are obtained by graduating them, as before explained (317).

Upon the Lower Yards.

420. Lower yards are made of a single tree, or of two pieces scarphed together with a vertical scarph. The yard-arms, in both cases, are $\frac{5}{12}$ the diameter of the slings, when in a single piece; the yard is left in the eight-squares, at the middle; the after one to half the length of the yard, and the others, which are for the sling cleats and battens, $\frac{1}{8}$ the length of the yard. When the yard is formed of two pieces, there are no squares left, but the yard is formed to the round, and the battens hollowed.

421. The scarph to the yard made of two pieces, is about $\frac{1}{3}$ the given length and from three feet six inches to four feet, with the butt ends of the trees placed together. The lips of the scarphs are made about one inch and a half in thickness, and the scarph is formed straight up and down, to about $\frac{1}{6}$ from each end, from which place it increases in round to the lip of the scarph, where it is the same round as the yard, in order that the breadth of the lips may not be too narrow. The scarph has one circular coak under each hoop as far as the surface is straight.

To Hoop the Lower Yards.

422. The number and place of the hoops on the yard arms are governed principally by the knots; the hoop nearest the slings is placed about $\frac{1}{7}$ the length of the yard out, or so as to cover the worst knot near this distance; the outer hoop so as to cover the worst knots from two to three feet within the inner hoop, on the yard arm irons. The quarter iron, which is placed $\frac{3}{16}$ the length of the yard from the outer end, is made to answer if possible for a hoop; then between the quarter iron and inner hoop, and quarter iron and outer hoop, one or two others are placed so as to cover the worst knots. The yard arm that is formed from the top end of the tree, governs the number of hoops, and on the other arm the same number is in general placed, but spaced so as best to close the shakes. On the scarph of the made yard one hoop is placed about nine inches from each lip; between these the others are placed, as near as they will space to two feet six inches apart, from centre to centre.

To Bolt the Scarph.

423. The scarph is bolted with one through bolt in each circular coak in the thick part of the scarph, and one rag-pointed bolt through each coak in the thin part.

Upon the Cleats.

424. Upon the yard arm one cleat is placed on the fore, and one on the aft side, $\frac{3}{72}$ the length of the yard in from the outer end. The sling cleats

are placed on the fore side of the yard, one on each side, and at equal distances from the middle; they are one diameter and $\frac{1}{2}$ of the mast apart. The yard arm cleats are in length $\frac{5}{8}$ the diameter of the yard, and fastened with two nails. The sling cleats are one diameter and $\frac{1}{2}$ of the yard in length, and fastened with one rag bolt and three nails (Note 74).

Upon the Battens.

425. Battens are placed on the aft, upper, and lower sides, the same length as the squares, and on the fore side between the sling cleats (424). These battens are in thickness for yards $12\frac{1}{2}$ inches diameter and under, one inch and $\frac{1}{2}$, and upwards two inches in thickness; they are fastened with nails about three feet apart, on alternate edges, and have their ends rounded off and snaped.

Upon the Boom Irons.

426. Boom irons are placed upon the main and fore yards, for the convenience of fixing the studding sail booms; there are two on each side of the yard; the outer one is called the yard arm iron, and the inner one the quarter iron; the outer one has two parts, the strap, which is let on lengthways upon the yard, and the crank, which projects at right angles to the strap, with a ring connected with it to receive the boom; in this ring is fixed a roll for the ease of running the booms out. The quarter irons are placed at $\frac{3}{16}$ the length of the yard from the outer end; one part is formed as a clasp hoop (Note 68) to span the yard, and is set tight by two keys; to the shank or chock of this iron is con-

nected a ring, likewise to receive the boom, but with a clasp, having a joint and key for fastening it, and for the convenience of topping the boom; this joint cuts the ring into two equal parts, and the centre of the joint and pin, or key, is in the same plane with the upper foremost eight-square, so that the boom may be prevented rolling out with the motion of the ship, when the clasp is open, and at the same time the boom may be topped with the greatest ease. This iron, by being driven tight upon the yard, answers for a hoop; but as its station is fixed, it often becomes necessary to have a hoop very near it, to cover a knot. The boom-irons are placed so that a line passing through the middle of the shank of the outer, and chock of the inner, may pass through the angle formed by the foremost eight-square, and foremost upper eight-square, and the center of any section of the yard, or which is the same, a line drawn through the middle of their shanks, and cutting the center of any section of the yard, will form an angle with the horizon of $22° 30'$. The roll is so placed in the ring of the outer iron, that the pin or axis may lie horizontal. The yard-arm iron is fastened with two hoops, with one saucer-headed bolt driven through between them, and two nails in the ends.

Upon the Topsail Yard.

427. Topsail yards have their ends or yard-arms $\frac{3}{7}$ the diameter at the slings, or given diameter; and the eight-squares left to $\frac{1}{8}$ the given length on each side the middle. These yards have one shive placed vertically in each end, with the outer part $\frac{7}{8}$ the given diameter from the end of the yard.

To Batten the Yard.

428. The foremost, after, upper, and lower eight-squares have battens the whole length of the squares placed upon them; and to yards from 11 inches in diameter, to main and fore, upwards, they have ekeings placed between them, and are hooped. These battens, when the yard is hooped at the middle, are of oak, and in thickness to $12\frac{1}{2}$ inches in diameter, one inch and a half; and upwards, two inches in thickness. When they are not hooped, the battens are in general fir, and one inch and $\frac{1}{4}$ thick.

To Hoop the Yards.

429. When the topsail yards are hooped at the middle, four hoops are driven upon the battens, and upon the ekeing, which, with the battens, are made cylindrical, one placed about nine inches from each end of the battens, and two between, at equal distances. The yard-arms have as many hoops upon them as the arm formed from the top may require, on account of the knots, placing them, in general, upon every other rim of knots, or on those that are the worst collared.

Upon the Cleats.

430. The yard-arm cleats are placed, one on the fore side, and one on the aft side of the yard; to the fore and main topsail yards, $\frac{1}{12}$ the length of the yard in from the outer end; and to the mizen topsail, $\frac{5}{72}$ of the length. The sling cleats are placed upon the batten, on the fore side, at an equal distance on each side the middle, and apart once the diameter of the topmast. The sling cleats are

in length once the diameter and $\frac{1}{3}$, and the yard arm $\frac{3}{4}$ the diameter.

Upon the Boom-Irons.

431. The fore and main topsail yards have boom-irons fixed on their yard-arms, with the outer arm or crank of the iron made to ship and unship; and when in its place, a line passing through the middle of the crank will pass through the center of the yard and the middle of the foremost upper eight-square, or make an angle with the horizon of 45°. The edges of the straps will lie horizontal, so that the pin for the shive will pass through them; they are fastened with hoops, and a bolt, the same as those to the lower yards (426). The mizen topsail yard has no boom-iron, but a ferrule driven on, and an eye driven into the end of the yard.

Upon the Cross Jack Yard.

432. The cross jack yard has the yard arms $\frac{3}{7}$ of the slings, and the eight-square left on the aft side to $\frac{1}{2}$ the length of the yard; the upper, lower, and fore side of the yard is left in the sixteen squares $\frac{1}{4}$ the length of the yard; these yards have a ferrule at each end.

To Batten the Yard.

433. This yard has only one batten on the aft side, the whole length of the eight-square.

To Cleat the Yard.

434. The yard arm cleats are placed, one on the fore and aft side, $\frac{1}{24}$ the length of the yard

from the end; but when the yard is longer than the fore topsail yard, they are placed $\frac{1}{24}$ within the fore topsail yard. The sling cleats are placed on the fore side, at an equal distance from the middle line, and apart the diameter of the yard (Note 75).

Upon the Spritsail Yard.

435. The spritsail yard has the arms $\frac{5}{12}$ the diameter at the slings, and is left in the sixteen squares at the middle, to $\frac{1}{4}$ the length of the yard, with a ferrule and eye.

To Cleat the Yard.

436. The yard arm cleats are placed, one in the fore and aft side on each arm, at $\frac{1}{24}$ the length of the yard from the end. The sling cleats are at an equal distance on each side the middle, and on the under side of the yard, and to be apart $\frac{7}{9}$ the diameter of the bowsprit.

Upon the Topgallant Yard.

437. The topgallant yards are at the ends $\frac{5}{12}$ at the slings, and are left in the eight squares at the middle, $\frac{1}{4}$ of their length; these yards have a ferrule and eye at each end.

To Cleat the Yard.

438. The yard arm cleats are placed, one on the fore and aft side at each arm, at $\frac{1}{24}$ the length of the yard from the end; and the sling cleats are placed on the fore part, at an equal distance on

each side the middle, and apart the diameter of the topgallant mast.

Upon the Royal Yards.

439. The royal yards are at the ends $\frac{5}{12}$ the slings, and are left in the sixteen squares at the middle, $\frac{1}{4}$ the length of the yard.

To Cleat the Yards.

440. These yards are cleated the same as the topgallant yards (438).

Upon the Studding Sail Yards.

441. The studding sail yards are in the same proportion at the yard arms as the topgallant yard, but are rounded quite through.

UPON THE BOOMS, &c.

Main and Driver Boom.

442. These booms have the given diameter $\frac{1}{3}$ from the after end, which is the butt end of the tree, or at the sheet or taffrail; their outer ends are $\frac{3}{4}$, and fore ends $\frac{2}{3}$, the given diameter; this proportion will answer for driver booms; but for main booms, or all booms worked as the main boom of cutters, the greater proportion should be at the inner end, as within the sheet will be found to have the greatest stress. These booms are rounded all the way through, except from four to five feet, where they are left square for the jaws. A necking

is formed at the outer end, in length about the given diameter.

Upon the Jaws.

443. The jaws are of oak or elm; they are in length from four to five feet from the fore end of the boom, and in depth from $\frac{3}{4}$ to one inch less than the boom at the fore end. The boom is worked to a tongue at the fore end; when the jaws are in one, the tongue is one inch and $\frac{1}{2}$, but when in two, it is $\frac{1}{3}$ the diameter of the boom at the end. The tongue is formed, from six inches from the fore end of the jaws, so that an angle is made $\frac{5}{8}$ of an inch in; from this place to the fore end it is straight to the proportion given. The jaws are formed to a semi-circle, one inch larger than the diameter of the mast, for leather and play; six inches from the fore end, they are left an inch and $\frac{1}{4}$; at the fore end, $\frac{5}{8}$ of an inch, and at the foremost hoop or at about 11 inches from the fore end of the boom, they are made one inch and $\frac{1}{2}$ larger than at the six inches from the fore end, for driving the hoops; from this place they are formed with an inflected curve, so as to follow and give sufficient strength to the hollow of the jaws; the fore ends are rounded each way, and the hollow is leathered with the leather let in flush, on the under side, so as to work on the saddle.

444. When the jaws are in one, they are left solid about 11 inches from the hollow, and are formed out to receive the tongue.

445. The jaws have in general four hoops driven upon them, one over the butt of the tongue,

if the jaws are in one, or 11 inches from the hollow; one seven inches from the fore end, and two at equal distances between. Under the third hoop from the fore end, a horizontal bolt is driven through the boom and both parts of the jaws, and one strengthening bolt is likewise driven about $2\frac{1}{2}$ inches from the hollow. Under the two foremost hoops, a nail is in general driven, on each side, through the jaws into the boom.

Upon the Blocks.

446. Cutters have in general two cheek blocks on each side of the boom, for reefing; they are in depth about half the diameter, and in length three times their depth; they are placed so as best to answer for the reefs; the outer one is placed on the starboard side, about three feet from the outer end to the centre of the shive; the next on the larboard side, about two feet four inches from centre to centre of the shive; the other two, on alternate sides, about two feet from centre to centre of the shives: these blocks are let in as much as the boom rounds in their depth, and have their ends rounded. There is one eye bolt driven through from the opposite side of each block, which passes through, and answers for the pin of the shive.

447. The booms of ships and brigs have in general (though it is seldom used) one vertical shive about one inch and a half within the necking, and one cheek block placed on each side for the topping lift. These blocks are in depth about half the diameter of the boom, and in length about three times the depth. The shive hole is in general the depth of the block, and $\frac{2}{6}$ in length.

Upon the Gaff.

448. The given diameter of the gaff is at the inner end; and the given length is set off on the upper part, beyond which three feet are allowed for displaying signals; the outer end is half the given diameter. The gaff is round, except in the place of the jaws, where it is left square.

Upon the Jaws.

449. The jaws are formed and secured, in every way, the same as to booms (443), except that the hollow is formed to an angle, up and down, that it may be in the direction of the mast when the peak is hoisted; they are mostly formed to an angle of 45°, but the angle that is intended for the gaff to form with the mast, should determine it. They are always leathered in the hollow.

450. One eye-bolt is driven up and down, from the upper side, in the direction of, and about eight inches from the fore end, for the throat haliards; and one small eye-bolt from the lower side for the down-hauls.

451. Ships and brigs have a shive hole, up and down, a diameter from the outer end, and a ferrule and eye. The eye up and down.

Trysail Gaff.

452. The trysail gaff has the length set off from the upper part, but has no additional length allowed; the given diameter at the inner end, and the outer end, is $\frac{3}{5}$ of the given diameter. A ferrule

eye is fitted to the outer end, and the jaws are the same as to the gaff.

Upon the Trysail Mast.

453. The trysail mast is in diameter from $\frac{1}{3}$ to $\frac{1}{2}$ the diameter of the mizen mast; the larger proportion is the most suitable. This mast is rounded all the way through, and is of an equal diameter the whole length. The trysail mast sometimes steps on a clasp hoop, with an eye to receive it, at other times on the boom, but most frequently on the partners, with a cleat round the heel; it is secured in the head by an elm cap between the trestletrees, or by a bolt or fid that passes through its upper part, and rests upon the trestletrees.

Upon the Jib Boom.

454. The given diameter of the jib boom is at the bowsprit cap, or at $\frac{1}{3}$ from the inner end, to which distance it is made parallel, and the outer end is made $\frac{2}{3}$ of the given diameter. The butt end of the tree is worked inwards; and the jib boom is left in the eight-squares, three diameters from each end. At the outer end a necking is formed to an eight-square, one diameter and $\frac{1}{6}$ in length; an inch and a half within the necking is a vertical shive, in length a diameter and $\frac{1}{6}$; and at the extremity is a vertical half shive upon the necking; about two inches within the inner part of the half shive is an iron for the flying jib boom, it is placed upon the middle starboard upper quarter eight-square, and stands up to an angle of 45°. At the inner end is an horizontal hole, $\frac{3}{4}$ of the diameter

from the end; and $\frac{3}{4}$ of the diameter within the hole is a horizontal shive, in length the diameter and $\frac{1}{6}$.

Upon the Flying Jib Boom.

455. The flying jib boom, in general, steps in the cap; when its length is $\frac{2}{3}$ the jib boom, and $\frac{2}{3}$ the given length of the flying jib boom. The outer and inner ends are made $\frac{2}{3}$ of the given diameter, and its given diameter is at the iron or end of the jib boom, from which place it is parallel to $\frac{2}{3}$ the given length from the inner end; from these distances to the ends, it is graduated according to the common method (317).

456. A necking is formed to one diameter within the outer end, and a vertical shive is placed one inch and a half within the necking; and at the inner end it is left in the eight-squares to three diameters; and a hole, one diameter out, is bored horizontally.

Jib Boom and Flying Jib Boom in one.

457. When the jib boom and flying jib boom are in one, the length to the stops will be the length of the jib boom; and from the stops to the outer end, will be $\frac{2}{3}$ the given length of the flying jib boom. At the stops the jib boom will be $\frac{2}{3}$ the given diameter; and at the extreme end, $\frac{1}{2}$ what it is at the stops. The inner end is formed, and has a hole and shive, the same as the inner end of the jib boom (454); and the outer end has a necking and shive the same as to the outer end of the flying

jib boom (456); but within the stops are placed two vertical shives, the outer one four inches within the stops, and the inner one $\frac{3}{4}$ the diameter within the outer.

Upon the Studding Sail Booms.

458. The swinging or lower studding sail booms, are formed to the same proportion as driver booms; they have a necking at the outer end and a goose neck and ferrule at the inner end.

459. Top and top-gallant studding sail booms are in length, $\frac{1}{2}$ the length of their respective yards; the given diameter is at $\frac{1}{3}$ from each end, between which they are made parallel. The ends are $\frac{2}{3}$ of the given diameter; at the outer and inner end is placed a ferrule and eye.

Upon the Defects of Masts, &c.

460. Masts are defective either by their being decayed or sprung, that is, by their elastic force being in part, or wholly overcome through fracture, &c. Decay has been found by experience to be the most frequent defect, and may arise from age; or if premature, from the bad quality of the materials, or the manner of combining them; springs may arise from age, defects in materials, or the impulses that act upon them being too powerful for the combined effort of the mast, rigging, &c. to resist.

461. Springs are discovered by shans and fractures, and sometimes by the fibre suffering by compression, while the continuity of the fibre is not

wholly overcome (Note 76); shans are mostly in consequence of the defect of the materials, most commonly from bad collared knots, and from the range of fibre not being in a direct line with the masts, &c. Fractures are the effect of the age of the mast, or by too powerful stresses acting on them; they are discovered generally in two forms, one with a black waved and jagged line across the mast, &c. the other forming between shakes or longitudinal openings, short fractures, that rise one above the other in the form of steps; this is commonly called Jacob's ladder. This fracture in general takes place in single-tree masts, and topmasts; it is a defect that seldom admits of repair.

462. When fractures appear without any known cause, as the uneasy motion of the ship, or having had to sustain any violent impulses, it may be considered as the effect of the internal weakness of the mast; and when the mast complains, or gives signs of weakness, without any external appearance of decay or fracture, &c. it may be considered as arising from the same cause, and most probably it is sprung or decayed internally, especially if the mast has been in service more than five years.

463. When any part of a mast, &c. suffers by compression, or buckles, or what is technically called having the grain upset, and the fibre in different parts takes a sinuous form, it is a proof of considerable weakness, and that it must, if a made mast, have worked considerably; though this defect is most common to masts of small vessels, that have considerable rake.

464. To discover the defects of masts and their extent,—if for decay, the mast, &c. is commonly bored with a very small auger, about three feet apart, or at the lower edge of each hoop, into the centre, boring them alternately athwartships, and fore and aft, and to take out the chocks or ekeings under the clasp hoops, to search in the place of the wedges at the different decks, and at the edges of the cheeks, both on the fore and aft fishes and side trees. When fractures are discovered, to ascertain their extent, it is common to take off shavings deeply, with a plane first, and if the black mark of the fracture still appears, to take a sharp instrument called a chissel, and penetrate, by taking off small portions at a time, till the defect begins to disappear; then the depth of the incision will determine whether the mast, yard, &c. or part of the mast where it takes place, ought to be condemned; if a Jacob's ladder, a narrow instrument or chissel is made to pass between the shakes. To discover the defects of a mast to the greatest certainty when it appears weak, without any visible defect, it is common to take off the cheeks, drive the body hoops off, and take out the aris pieces, to give an opportunity of examining the edges of the fore and after fishes, and side trees; and all masts, yards, &c. when properly examined, have the paint or other substances taken off their surfaces, and planed all over to shew the smallest defect.

465. Fractures mostly take place to *made masts* from the tail of the cheek to the deck, though frequently the mast becomes buckled from the middle of the cheek, upwards; but this commonly takes place through improperly staying and setting

up the rigging, and at the wedges, especially at the head of them; *single-tree masts without cheeks* at the lower part of the hounds and wedges; *cutter's masts* just below the hounds, upper part of the wedges, and in the wake of the jaws of the boom; *topmasts* at the lower part of the hounds, and at the cap; *bowsprits* on the upper part principally, and the sides between the gammoning and the chock, or bed.

466. When the nature of the defect is such as to require that the mast, &c. should only be strengthened, if to a made mast, a fish is applied, similar to the front fish (353); but if a single tree mast, they are strengthened by what is called a flat sole fish, that is, by taking off the round of the mast, on the side of the defect, to form a seating with two other seatings, about half as wide as the first, at its intersection with the circumference; upon these three seatings, a fish and two ekeings are brought, and hooped as the front fish (355). These fishes should run through the wedging deck, so as to have a hoop below. Bowsprits may be fished as masts, if not too far gone; if a single tree, by a flat soled fish, and if made by a fish, similar to the front fish; these fishes always run through the bed to receive a hoop within.

End of Mast Making, &c.

NOTES.

Note 1.

Caulking is the operation of forcing oakum into the seams, rents, and butts, by means of a mallet and iron; this operation is the same as the force of the wedge, when acted on by impact, to close all the smaller rents, and to make the different parts as one body, in opposing the passage of the water (see *Caulking*).

Note 2.

The form given to the bodies of ships is such, that although the whole vertical pressure of the fluid is equal to the weight of the ship; yet the vertical pressure on every portion of the body, is not equal to the superincumbent weights, which is seen by the following table of weights and vertical pressures on a ship of 74 guns of the second class.

ON THE FORE BODY.

		Weights.	Vertical Pressure.	Moments of Weight.	Moments of Pressure.
	Feet.	Tons.	Tons.	Tons.	Tons.
From ⊙ to	20,85	511,7	461,2	11390,9	7166,4
Feet. 20	37,60	437,6	363,0	14171,4	15572,4
37,60	54,35	262,2	330,0	11976,9	15146,4
54,35	71,10	226,2	250,6	12560,8	10729,0
71,10	extremity	148,6	93,4	5715,1	4812,6
Total on the fore body		1586,3	1504,2	55815,1	53426,8

ON THE AFTER BODY.

From	To	Weights.	Vertical Pressure.	Moments of Weight.	Moments of Pressure.
Feet.	Feet.	Tons.	Tons.	Tons.	Tons.
From $\odot$	to 18,23	369,5	405,4	3038,2	3674,6
18,23	34,98	289,4	356,8	7364,4	9449,4
34,98	51,73	234,2	317,0	9916,6	13663,8
51,73	68,48	230,2	249,0	13780,4	14801,4
68,48	extremity	278,0	153,8	21719,5	11829,4
Total on the after body		1401,3	1482,0	55819,1	53418,6
on the fore body		1586,3	1504,2		
Weight of the hull and all it contains		2987,3	2986,2		

The consequence of this unequal distribution of the weights with the pressure of the fluid is, that the body will endeavour to assume a form by the rising of the middle part, and falling of the extremities to equalize the pressures; this can only be prevented entirely by rendering the body perfectly rigid, but as this can never be the case, the extremities will fall more or less according to the materials, and the manner in which the parts are combined; this falling is called hogging.

Note 3.

This may be inferred from natural principles, for after the ship has assumed a curved form, there is an equilibrium round the neutral line; therefore the effect to prevent extension, is equal to the effect to prevent compression, and the sum of these two, or twice the effect to prevent extension, since they are both equal, is the resistance to arching.

Note 4.

The *ulmus campestris* and *montanus*. The *campestris*, or wych, is very free grained, therefore seldom used for keel pieces.

NOTE 5.

The garboard seam, is the joint between the lower edge of the garboard, or lower strake of the plank of the bottom and the keel (see *Seam*).

NOTE 6.

The extreme ends of the exterior planking forward are called the fore hoods, or wooding ends (96).

NOTE 7.

Cheeks are knees brought on each side of the knee of the head for supporting it, and at the same time forming ornamental mouldings, which terminate at the figure with scrolls (see *Head*).

NOTE 8.

Boxing is leaving of projecting wood for different purposes, as the wood left to the thickness of the exterior and interior planking, at the upper part of the knight heads, and at the post timbers, &c. hence the boxen is left for the lower part of the gripe.

NOTE 9.

(See *Head*).

NOTE 10.

Braces are straps of mixed metal (Note 11) or iron above water, which are secured to the stern-post and plank of the bottom for hanging the rudder to (see *Rudder*).

NOTE 11.

Mixed metal is a compound of copper and zinc, mixed with grain tin to give it sufficient rigidity.

NOTE 12.

If the inner post was not introduced on the fore side of the main post, it would be necessary to prevent the

fastening of the hooding ends coming in the same range of fibre, to have the main post considerably wider before the rabbet, which would be attended with disadvantages. When transoms were used, a score was taken out of the inner post, the depth up and down of the transom, and likewise a score out of the transom, sufficiently on to let the transom aft to the rabbet or bearding; and of a width to allow a facing to be taken out of the side of the inner post, from one inch to one inch and half from the inner part of the score, to the bearding or rabbet.

Note 13.

To halve two pieces together is to take equal portions off from each, at the places where they unite, that their two surfaces may be fair with each other.

Note 14.

When the ship has a rise of floor and considerable floor hollow, pieces are brought under the heels of the timbers and to the form of the body, to take away the small chocks that must necessarily be brought on, to aid the conversion; these pieces, instead of being brought to a sharp at the lower and upper edges, should be formed in a rabbet (as shewn by *x* Fig. 16), square to the body, both into the deadwood and under the timbers, that the caulking of the frame may be good, and for properly fastening the garboard and other strakes that may come upon them. Forward the stepping pieces have been made to form an abutment for the stem-pieces or knight-heads, and aft, a similar rabbet to that taken out of the deadwood, has been taken out of the stern and inner post for the post timbers, which is then bolted and coaked similar to the knight-heads, that there may be the better security for the hooding ends. Aft, or where the body is acute, two or three breadths of these pieces are worked one above the other, to prevent having chocks upon the heels of the timbers in this place.

Note 15.

The cutting down is the depth from the upper edge of the keel to the upper part of the floors, at the middle; and the line bounding the upper part of the floors, and upper part of the deadwood before and abaft the floors, is called the cutting down line.

Note 16.

Knee timbers are formed by the trunk and branch of the tree.

Notes from 17 to 25.

The flat floors now, as well as the rising, have the half floors to abutt against each other, and have a circular coak in their abutment.

Note 26.

The top side is the upper extremity of the timbers of the frame, before the fore drift, and abaft the main drift. The line that bounds the heads of the timbers between the drifts, or the uppermost line that can be carried the whole length of the ship, parallel to the sheer, without being broken off by the drifts, is called the top timber line; this line terminates the frame between the drifts.

Note 27.

The heads and heels of the timbers are the parts that form their abutments against each other; the head being the upper part, and heel the lower part of the timber.

Note 28.

The port timbers are the timbers that form the sides of the ports, and in general have an excess of siding from one inch to one inch and half.

Note 29.

The room and space, or what is sometimes called timber and space, is the distance from the joint or middle, between the two assemblages of timbers of the frame, to the joint of the filling frame; therefore while the scantling or siding of the timber is constant, the greater the room and space, the less the quantity of timber in the frame.

Note 30.

This is called levelling and horning the floors.

Note 31.

(See Note 26).

Note 32.

Shores are props placed under the ribbands, and at different parts of the frame, or against the sides and bottom, to support the ship while building.

Note 33.

The round stern is a new mode of constructing the stern or after extremity of the ship, designed to make them more effective at this part in time of battle, by giving a greater latitude to the training of the guns.

Note 34.

To forelock the bolts is to secure their points from passing through the wood, by having a mortise in them, and a thin wedge of iron driven through them.

Note 35.

Siding is the breadth of the timber, whereas the imensions, or scantling in and out, is called the moulding.

Note 36.

With this frame, timber that before would only

answer for the frames of frigates, is brought into use for ships of the line (see *Quarterly Review*, vol. 22, page 46).

NOTE 37.

By an experiment made on the frame (66) of two ships, one on the common (71), and the other on the new principle of building (82), it was found that the latter exceeded the other in strength very considerably (see *Quarterly Review*, vol. 22, page 47). This may arise in part from the workmanship, as the strength of the common frame depends greatly on the manner in which it is put together, occasioned by the faying, and the abutment of the chocks being close. Whereas the new frame having but a simple abutment, and the certainty of the circular coak being close, has the advantage in an experiment of this description; but however this may be, the system that is most simple, and depends the least upon the workmen, where considerable works are carrying on, must have the superiority.

NOTE 38.

The strength of an assemblage of pieces can be considered only in degrees, as the parts are combined, and they are brought to act in mass.

NOTE 39.

At present, timber from the Brazils has been employed for this purpose.

NOTE 40.

(See NOTE 32).

NOTE 41.

Frigates and upwards, are mostly built on temporary keels, made of fir of the most inferior quality; as it was found on account of the long standing of these classes of ships, that the permanent keel becomes decayed.

Note 42.

This has the advantage as to conversion, by bringing the top or main end to the butt or wide end, making the breadth of the two equal to the breadth of the wide and narrow end together; whereas if they are worked parallel, the breadth of the two could only be equal to the two narrow ends.

Note 43.

The chain bolts are the bolts that secure the chains of the dead-eyes, and the preventer bolt passes through a plate, called the preventer plate, at some distance down, for aiding the chain bolt, when the strain from the shrouds is brought upon them.

Note 44.

Port stops are the ends and edges of the planks left round the ports, from one inch and half to two inches and quarter, from the sides of the timbers and upper and lower parts of the sills, to receive the port lids and half ports.

Note 45.

Shaken or shaky, is when the adhesion of the fibre is overcome, or when the timber or plank is full of splits or clefts, the same as wind shocks.

Note 46.

Tabling is the letting of one piece into another, so that they may have abutment to oppose any strain lengthways.

Note 47.

Between the trusses the surface of the timbers is covered by plank, similar to the quickwork.

NOTE 48.

While the angular form of the parts is preserved, and there is an extension above the neutral axis, the trusses, with their present position, will not be brought into action; but when the stiffness is overcome, and the different parts yield to the forces impressed, the extremities will have a tendency to drop, which will then be resisted by the abutment of the trusses; for if the parts at the extremities were only subject to the influence of compression and extension, and not to drop vertically (292), it would be difficult to account for the angles formed by the edges of the quickwork and port timbers (NOTE 28), being altered so much in ships that have broken their sheer to a considerable extent.

NOTE 49.

See NOTE 28.

NOTE 50.

Cylindrical pieces of oak, or other hard woods, used as pins to fasten the planks and other parts of structure. Metal fastenings are iron, copper, or mixed metal (NOTE 11).

NOTE 51.

The number of bolts that necessarily pass through in the wake of the decks, cut the timbers considerably in some parts without the treenails, and it frequently occurs that a bolt and treenail pass close to each other, or that the treenail is cut partly by the bolt.

NOTE 52.

A much greater degree of oxidation goes on when the iron fastening is combined with the salt water and the acids contained in the oak, than when exposed only to the oxygen of the atmosphere, or in fresh water; but an active galvanic combination is produced, and oxidation goes on

still faster when the bottom is coppered and there is iron fastening; because then there are two metals possessing different degrees of oxidability, combined with a fluid (fresh or salt water) that is capable of oxidating either.

NOTE 53.

The introduction of half beams generally, which give the flat of the deck a greater degree of firmness against the recoil and percussion of the gun when firing fast, makes it of less importance that the beams should be under the trucks.

NOTE 54.

The quantity will be increased in about the following proportion. If a single piece be 1, a two piece will be 1.16, a three piece 1.25, and a four piece beam 1.3; but the increased expence will not be so great as these proportions, because timber increases in value in a greater proportion than its dimensions.

NOTE 54.

The proportions given for the length of the searphs are not always attended to; they are now in general made in length from 9 to 12 feet, according to the rate of the ship and situation.

NOTE 55.

See NOTE 16.

NOTE 56.

The lodging knees are placed on the aft side of the beam before the middle and fore side abaft, that the knees may be obtuse angles, or without a square, for the ease of getting them, and that they may be of less expence.

NOTE 57.

The toes of the knees are the extreme ends; they are in general rounded off.

Note 58.

Saucer heads are large flat heads of a circular form (see *Bolts*).

Note 59.

See *Philosophical Transactions*, 1814, part 2, page 301.

Note 60.

See *Philosophical Transactions*, 1814, page 297.

Note 61.

To chince or chinse, is a slight mode of caulking any seams or butts.

Note 62.

Parker's Roman cement $\frac{2}{3}$, drift sand $\frac{1}{3}$.

Note 63.

The ledges, after being some time in the ship, shrink from the scores, they therefore could give but little firmness to the flat, and the manner in which they were fixed could form no tie to the different parts of the structure to which they are in conjunction, no more than their connexion with several strakes.

Note 64.

The mast head above the lower part of the lower hoop has its angles rounded off in an easy manner; for by making it cylindrical, a proper seating for the cap could not be obtained. The angles are first taken off to $\frac{1}{7}$ the size of the mast head each way, and then the other angles formed are taken off to $\frac{1}{4}$ the size of the squares, till they are reduced sufficiently small to form a fair curve with a plane.

Note 65.

Knots are bad collared, when the fibres that take a sinuous form round them are separated.

Note 66.

To cheek a mast causes a great consumption of timber, as one of 22 inches in diameter will take for the cheeks the best part of a 19 inch tree; but when they are cheeked in most cases, especially those above $19\frac{1}{2}$ inches in diameter, they may be made of yellow pine, as red pine seldom exceeds this dimension, which will reduce the expense.

Note 67.

See Article 355.

Note 68.

Joint or clasp hoops are used where it is impracticable to drive hoops; they have sometimes a joint which is placed on the aft side of the mast, but mostly the spring of the iron is sufficient to allow them to open, and on the fore side with the two parts to clasp each other with mortises, which have wedge-like keys driven in to set them tight; these keys when hot are formed close to the mast, and are mostly covered with lead to prevent any ropes catching under them.

Note 69.

The circular coaks in the spindle, when in two, should be placed about 9 inches below the hoops, as those in the side trees are 9 inches above, and those in the fishes under the hoops, that they may not all be, in the several pieces, in the same transverse section.

Note 70.

Fanned is a technical phrase for widening, being fan like.

Note 71.

The lubber wood is a projecting wood left on the upper part of the crosstrees for keeping the top in its position.

Note 72.

To champher is to take a small portion of the angles off.

Note 73.

On the outer part of the bees, close to the after bolts, is a small shive on each side, the thickness of the bees and $\frac{1}{6}$, standing outwards at its after end $1\frac{1}{2}$ inch.

Note 74.

These cleats are square at the large end for the slings, from $\frac{1}{7}$ to $\frac{1}{6}$ of their length, and for the yard arms from $\frac{1}{6}$ to $\frac{1}{5}$.

Note 75.

The cleats to all the yards, except the lower yards, have the same proportions nearly for their length, and are square for the slings from $\frac{1}{7}$ to $\frac{1}{6}$, and for the yard arms from $\frac{1}{6}$ to $\frac{1}{5}$.

Note 76.

This compression of the fibre is frequently discovered in new sticks or trees.

Note on Art. 465.

Fractures, &c. may take place in other parts than these given in this article, but they will be found most common at these parts.

End of Notes.

INDEX AND VOCABULARY.

Abaft (Swedish, *akter*, *akterlik;* Danish, *agter*, *agterlig;* Dutch, *agter*, *agterlig;* German, *agter*, *agterlich;* French, *arrière;* Italian, *in poppa;* Spanish, *in popa;* Portuguese, *em popa)* behind, nearer to the stern. Ex. As the fore or main sheet bitts are before the mast, and the jeer bitts abaft, that is, the sheet bitts are nearer the head, and the jeer nearer the stern than the main mast.

Aboard (Swedish, *om bord;* Danish, *om bord;* Dutch, *aan boord;* German, *an bord;* French, *abord;* Italian, *abordo;* Spanish, *abordo;* Portuguese, *abordo)* the inside; to be on board, that is, to be within the ship or upon the ship.

Advice boats (Swedish, *adisbat;* Danish, *advisbaad;* Dutch, *adviesboot;* German, *advisboot*; French, *bateau d'avis;* Italian, *barca d'avviso;* Spanish, *embarcacion de aviso, de correo;* Portuguese, *embarcaçaom de aviso)* small vessels intended to carry dispatches; vessels built for swift sailing.

Afloat (Swedish, *flyta;* Danish, *være paa flot;* Dutch, *vlot zyn;* German, *flot seyn*; French, *flotter;* Italian, *galeggiare, essere a gala;* Spanish, *flotar, estar a flote;* Portuguese, *estar a nado)* to float upon the water; the ship is said to be afloat when she is clear of the ground and borne entirely by the fluid.

Afore, or right a-head (Swedish, *observera just rätt sörut;* Danish, *observere just läge forud;* Dutch, *regt van vooren observeeren;* German, *recht von vorne, etwas beobachten;* French, *droit avant;* Italian, *dritto per la prua;* Spanish, *observar algo derecho por la proa;* Portuguese, *observar direito pela proa)* See abaft.

Amidships (Swedish, *mittskepps;* Danish, *midtskibs;* Dutch, *midschips*; German, *mittschiffs;* French, *au milieu d'un vaisseau;* Italian, *nel mezzo della nave;* Spanish, *medinania;* Portuguese, *mediania)* signifies the middle of the ship, both as it regards the length and the breadth.

Anchor (Swedish, *ankar, ankare;* Danish, *anker;* Dutch, *anker;* German, *anker;* French, *ancre;* Italian, *ancora*; Spanish, *ancora;* Portuguese, *ancora, ferro*) a strong and heavy instrument by which the ship is held, by means of a cable, in any place. It is formed of three principal parts, the *shank* (Swedish, *läggen;* Danish, *læggen;* Dutch, *ankerroede;* German, *die ankerruthe;* French, *la verge;* Italian, *la verga;* Spanish, *la canna;* Portuguese, *a astea*): the *flukes* (Swedish, *flyna, flyet*; Danish, *sandborerne, sands paane, floyene*; Dutch, *ankertanden of handen, klouwen*; German, *die ankerflügel oder flünke*; French, *les pattes*; Italian, *le patte, le marre, le zampe*; Spanish, *las unnas*; Portuguese, *as unhas, as patas*): and the *stock* (Swedish, *ankerstocken*; Danish, *ankerstok*; Dutch, *ankerstok*; German, *der ankerstock*; French, *le jas*; Italian, *il cepo*; Spanish, *el cepo*; Portuguese, *o cepo).* The flukes or arms are welded to one extremity of the shank, and the stock is fixed afterwards, at right angles to them at the other. The part where the flukes or arms of the anchor connect to the shank is called the *crown* (Swedish, *ankarkors*; Danish, *ankerkrydset*; Dutch, *ankerkruis*; German, *das ankerkreutz*; French, *la croisée, la crosse, le diamant*; Italian, *la croce, il diamante*; Spanish, *la cruz*; Portuguese, *a cruz)*: the wide parts connected to the flukes are called the *palms* (see *flukes*), and the extreme point of the fluke, the *bill* (Swedish, *ankarnäbben*; Danish, *næbbet*; Dutch, *de punt*; German, *die ankerspitzen*; French, *le bec*; Italian, *la punta, il becco*; Spanish, *el pico*; Portuguese, *o bico de papagayo)*: the part between the flukes and shank is called the *throat* or *clutch* (Swedish, *ankarhalsen*; Danish, *det stærkeste af læggen hvortel armene ere smedede*; Dutch, *ankerhals*; German, *ankerhals*; French, *le collet, le fort de l'ancre*; Italian, *il collare, la parte la piu' forte del usto*; Spanish, *el cuello*;

Portuguese, *Cœllo)*; and a *ring* (Swedish, *ankarringen*; Danish, *unkerringen;* Dutch, *ankerring;* German, *der ankerring;* French, *l'arganeau;* Italian, *la cigalla, l'anello;* Spanish, *el arganeo;* Portuguese, *o anete)* passes through the end upon which the stock is connected for securing the cable; and upon the square of the shank, which lets into the stock, a projecting part called the *nut* (Swedish, *nötter;* Danish, *nöddern;* Dutch, *de neuten van het vierkant*; German, *die nüsse des ankerschafts*; French, *les tenons, les tourillons*; Italian, *le prese, le orecchia*; Spanish, *las orejas*; Portuguese, *as orelhas)* is left for confining it. The large part of the shank, which is from the throat equal to the length of the arms from the throat to the bill, is called the trend or trent.

The anchors supplied to ships are distinguished into the *Sheet* (Swedish, *pligtänkaret*; Danish, *pligtankeret*; Dutch, *pligtanker, stopanker*; German, *der pflichtanker, hanptanker*; French, *la grande ancre*; Italian, *l'ancora d'esperanza*; Spanish, *el ancla de forma, de esperanza*; Portuguese, *ancora de forma, ou de esperanza*): *Best Bower* (Swedish, *dageliga ankaret*; Danish, *däglig ankeret*; Dutch, *het dagelyks anker*; German, *der tägliche anker*; French, *la seconde ancre, ou ancre de veille*; Italian, *la seconda ancora*; Spanish, *el ancla de uso*; Portuguese, *segunda ancora)*: *Small Bower* (Swedish, *tög ankaret*; Danish, *tög ankeret eller fortöynings anker*; Dutch, *tuyanker, vertuyanker*; German, *der tey-oder tauanker*; French, *l'ancre d'affourche*; Italian, *la terza ancora*; Spanish, *el ancla de leva*; Portuguese, *terceira ancora)*: *Spare Anchor* (Swedish, *reserve ankar*; Danish, *reserve anker*; Dutch, *ruimanker*; German, *der raumanker*; French, *ancre de la cale*; Italian, *ancora di riserva*; Spanish, *ancla de respeto*; Portuguese, *ancora de respeito)*: *Stream* (Swedish, *varp ankaret*; Danish, *varp ankeret*; Dutch, *werpanker*; German, *der wursanker*; French, *l'ancre à jet ou de touée*; Italian, *l'ancoretta, l'ancorotto*; Spanish, *el anclote*; Portuguese, *ancorote, ou ancora de reboque, ancoreta)*: and *Kedge*. The sheet anchor is the heaviest and strongest, though varying but little in weight from the bowers and spare anchors; it is used when the other anchors come

home or drag, or in extreme cases. The bower anchors are the working anchors of the ship. The stream anchor is to ride in rivers, or to bring up for a short time, &c. The kedge is a light anchor, used for different purposes, as to prevent the ship from yawing from side to side, or to keep her steady when riding at single anchor, or in working up rivers.

The anchor-stocks are either of wood or iron. Iron stocks are seldom placed to anchors above 28 cwt.; they are in length the length of the shank and half the diameter of the ring, and are in size to the forelock hole equal to the small of the shank. The wood stocks are in length the length of the shank and half the diameter of the ring, and in size, at the middle, 1 inch in a foot, and at the ends, half an inch in a foot of their length. The stock is made straight, in the direction of the shank, on the part towards the ring; but the other way it is tapered equally on each side, commencing the tapering, both ways, at once, its largest size from the middle.

The stock is in two pieces, which are united together by four bolts, placed at half the largest size on each side of the middle, and $\frac{1}{4}$ from the edge; three or four treenails are placed at equal distances, and two hoops on each side, under 40 cwt.; and three to all anchors above. The two pieces have an opening left between them, at the shank, of about half an inch to an inch and a quarter: a chock about three inches wide is placed between them.

Anchor Linings (Swedish, *anker fodringen*; Danish, *ankerfoeringen*; Dutch, *ankervoedering*; German, *die, ankerfütterung*; French, *un coussin d'ancre*, *un renfort*; Italian, *un parabordo per l'ancora*; Spanish, *una concha*; Portuguese, *huma rapoza)* are planks fastened to the side of the ship to prevent the bill injuring it, or to prevent the bill from catching under any projection. The anchor lining is placed with its middle at a distance from the stopper cleat on the cat head, equal to the distance from the centre of the ring to the bill, and made to a curve for the bill to sweep up parallel to the fore part. When the anchor is stowed with the bill on the fore end of the channel, a bolster is then bolted to the side, of a height for the lining which is well with the outside of the channel rail at the upper

part, to be in the direction of the chains, with from 3 to 4 bolts, extending from about 10 to 15 inches before the lining; and upon it two or three stanchions are fixed, with their upper part rather less than the thickness of the lining within the outer part of the channel rail, and the lower end snaping so as to form an equal abutment against the side, and on the bolster; to these stanchions the lining, above the bolster, is fastened; below the bolster, one or two breadths of lining is fastened to the side, with their lower parts rounded into the side. When the anchor is stowed with the bill before the fore end of the channel, the bolster is placed at the height of the channel, and the lining is placed close to the side, from the first projection of the wale to the under part of the bolster. When the anchor stows on the channel, a bill-board is placed with its outer part resting upon the outer part of the channel, and the inner end against the side of the ship, to the height of the forecastle sills, or to such an inclination that the anchor will slide off when the shank painter is let go; upon this board as high up as the bill of the anchor comes, or home to the side, and down the anchor lining about nine inches, is fixed a plate of iron, called the bill-plate, to prevent the bill from rubbing the wood. Bill-plates are likewise placed upon the bolster when it is at the height of the channel for the same purpose.

Anchor Chock, a chock bolted upon the gunwale abaft the fore drift, for the fluke of the sheet and spare anchor to rest upon, when these anchors are stowed; it is of an height for the palm to be above the deck, and sufficiently aft for the stock to stow between the ports. If the bill is not abaft the channel when stowed, a bill-board is placed upon the channel to carry the anchors clear; if it comes abaft, a bolster is bolted to the side, and a bill-board upon it. To prevent the stock from rubbing the channel rail, a plank is bolted to the under side of the channel, extending from the side to about 2 inches without the rail, and a stanchion or shore is placed under it, and against the side; this plank is bolted in general with saucer-headed bolts, driven down and forelocked on the under side of the plank.

Apron (Swedish, *följare innan på forstäcfven*;

Danish, *indenstevnen paa forstevnen;* Dutch, *binnensteven;* German, *binnensteven vorne, oder binnenvorsteven*; French, *contre-étrave intérieur*; Italian, *contraruota interiore*; Spanish, *contrabranque*; Portuguese, *contraroda)*—28, 29, 30, and 31.

Ash, *Fraximus excelsior* (Swedish, *ask*; Danish, *ask*, *aske*; Dutch, *esche*, *esch*; German, *eschen-holz*; French, *frêne*; Italian, *frassino*; Spanish, *fresno*; Portuguese, *freixo)*. This timber is used but for few purposes in a ship, principally for capstan bars, handspeck, and oars (see Timber).

Athwart (Swedish, *tvärt*; Danish, *tværs eller tverts*; Dutch, *dwars*; German, *dwars*; French, *à travers*; Italian, *al traverso*; Spanish, *al traves*; Portuguese, *ao travez)* transversely, lying or reaching across the ship, perpendicular to the longitudinal axis horizontally.

Badge (Swedish, *galleriets undre delen med fönster och trummor för äfträde*; Danish, *side galleriets undre delen*; Dutch, *germakken onder de zydegalleryen*; German, *seiten gallerie*; French, *bouteilles*; Italian, *camere fotto i giardini*; Spanish, *pié del jardin*; Portuguese, *pé do alforge)* in ships, an ornamental port, in small vessels and yachts, fixed near the stern, or where the quarter galleries in larger ships are placed, excepting that it is unconnected with the quarter pieces; it mostly has a sash for giving light, or for the convenience of the after cabin, which is in general of an oval form, sometimes richly ornamented with a canopy, marine figures, and the different genii, or with trophies; at other times it is a simple carved moulding encircling the sash.

Balcony (Swedish, *altan*; Danish, *agter gallerie*; Dutch, *agter gallery*; German, *hinter gallerie*; French, *galeria de poupe*; Italian, *galeria*; Spanish, *corredor*, *galeria*; Portuguese, *jardim)* a gallery, sometimes called sternwalk, formed formerly in the stern of large ships. Two deck ships had one, and three deck ships two; the lower one in three deck ships connected with the admiral's, and the upper one with the captain's cabins.

Ballast (Swedish, *barlast eller ballast*; Danish, *baglast*; Dutch, *ballast*; German, *ballast*; French, *lest*; Italian, *savorra*; Spanish, *laftre*; Portuguese, *laftro)*

heavy substances placed in the hold of a ship to regulate the trim, and to bring the centre of gravity of the system in its proper place. It is distinguished into metal and shingle; the metal is composed of lead or iron, but mostly of iron pigs 6 inches square and 2 feet 11 inches and ½ long, 7 of them making about a ton weight; the shingle consists of gravel, but now is very seldom used.

Bars of the Capstan (Swedish, *bräckbommar*; Danish, *vindebommer*; Dutch, *windboomen*; German, *wind bäume, spill bäume*; French, *barres du cabestan*; Italian, *manovelle dell' argano*; Spanish, *barras del cabrestante*; Portuguese, *barras do cabrestante)* are levers used to turn the capstan, when a great power is required; they are in number, to the capstans of sloops, nine; frigates and two-deck ships, twelve; and to ships of three decks, fourteen; and in length, to sloops 10 feet, frigates 12 feet, and to ships of the line 14 feet.

Bars to the Hatches or Scuttles (Swedish, *järn böglar til luckor*; Danish, *böyler til lugen*; Dutch, *beugels over de luiken*; German, *eiserne bügel über den luken*; French, *barres d'écoutilles*; Italian, *barre dei boccaporti*; Spanish, *barras de las escotillas*; Portuguese, *barras ou barrones das escotilhas)* plates of iron made to secure them down, to prevent embezzlement, &c.

Bars of the Ports, generally called port cants, are used for securing in the port lid. They fix into a score taken out of the quick work or abutment pieces (165) for their outside to come against the timbers, and have two hooks that pass through a mortice; these hooks fix to the shackle in the port lid, which are drawn in tight by means of iron wedges or keys.

Barge (Swedish, *capitains slup*; Danish, *chess sluppe*; Dutch, *kapiteins sloep*; German, *kapitains schlupe*; French, *canot du capitaine ou grand canot*; Italian, *lancietta del capitano*; Spanish, *bote del capitano*; Portuguese, *bote do capitaom)* a boat sometimes supplied to ships, but mostly boats of state, in general richly decorated.

Bark (Swedish, *bark*; Danish, *bark*; Dutch, *barkschip*; German, *barke order barkschiff*; French, *petit bâtiment destiné au service d'un port. Vaisseau marchand*

à trois mâts qui n'a ni poulaine ni bouteilles; Italian, *fregatta mercantile, seuza polena*; Spanish, *fragatta mercantil sin alas de proa*; Portuguese, *fragata mercantil sem beque).* A ship with three masts without a mizen topsail, or a general name given to small ships, especially those with broad sterns without a knee of the head and rails.

BARCA-LONGA, boats used in the mediterranean, principally by the Spaniards, for fishing boats; they are worked with two or three lug sails.

BARRICADING (120).

BARREL OF THE CAPSTAN (Swedish, *axel trumma*; Danish, *spillets tap*; Dutch, *wel van't spil*; German, *welle eines gangspill*; French, *mèche de cabestan*; Italian, *campana dell' argano*; Spanish, *mecha del cabrestante, molinete del cabrestante*; Portuguese, *madre du cabrestante)* the principal piece in the capstan (see CAPSTAN).

Barrel of the Steering Wheel (Swedish, *trumma*; Danish, *trumle*; Dutch, *wel vau't stuur-rud*; German, *welle des steuerrades*; French, *cilindre ou marbre de la roue de gouvernail*; Italian, *massa della ruota del timone*; Spanish, *masa*; Portuguese, *cylindro daroda do leme)* that part into which the spokes are fixed, and round which the wheel ropes pass (see WHEEL.)

BATTEN (Swedish, *lackter, ribbor*; Danish, *legter*; Dutch, *latten*; German, *latten*; French, *latte*; Italian, *latte*; Spanish, *latas, barrotines*; Portuguese, *latas)* thin and narrow strips of wood (see TIMBER). Gratting battens are those strips which unite the ledges that form the covering for the hatchways (see GRATTING). Battens to the hatchways are battens used for securing the tarpaulings over the hatchways in a storm, to prevent the sea finding a passage between decks.

BEAKHEAD, a platform at the foremost extremity of the ship, generally at the height of the port-sill; its fore part is formed with the bow, and its aft part terminated with the barricading which encloses the fore part of the ship, and from the forecastle to that platform, terminates the fore part of the forecastle, called the beakhead bulkhead. Ports were formed in this barricading which answered for doors to the head of the ship. The beakhead

was formerly common to all two-deck ships and upwards, but now is discontinued (Fig. 18), and the round bow is continued quite up.

BEAMS (Swedish, *balkar*; Danish, *bielkerne*; Dutch, *balken, deksbalken*; German, *balken, deckbalken*; French, *baux*; Italian, *latte, bai*; Spanish, *baos*; Portuguese, *vaos*) (185).

BED OF THE BOWSPRIT, is a solid bearing, formed out of the head of the stem and apron, to support the bowsprit; it is in general lined over with lead or copper to prevent the water getting below, should the different joints become slack by shrinking.

BEECH (*fagus sylvatica*) (Swedish, *bok eller bök*; Danish, *bög*; Dutch, *beuken-of boeken-hout*; German, *buchen, holz*; French, *hêtre*; Italian, *faggio*; Spanish, *haya*; Portuguese, *faia*). The common beech is used but for few purposes in ship building; principally shot-racks, chocks, as boom chocks, &c. and sometimes for some of the lower strakes of the plank of the bottom, as a substitute for elm (see TIMBER).

BENDS (66) see FRAMES.

BENDS, the main-wales (114) are frequently called by seamen the bends of the ship, or the widest part of the ship transversely.

BETWEEN DECK (Swedish, *mallandäck*; Danish, *imellem-dæk*; Dutch, *tusschen deck*; German, *das zwischen-deck*; French, *entrepont*; Italian, *corridore*; Spanish, *entrepuente*; Portuguese, *entre cubertas)* the space between any two decks.

BEVELLING (Swedish, *skefning*; Danish, *skevning*; Dutch, *het in den haak schaaven van een stuk houts*; German, *das schmiegen, die schmiegung*: French, *équerrage*; Italian, *lo squadrare ad angoli acuti o ottusi*; Spanish, *accion de cuadrar con la salta regla*; Portuguese, *a xeura)* the angles formed between one surface and another, as between the side of the timber and the outer surface, on the side and end, &c. When it is without a square, or an obtuse angle, it is called a standing bevelling, when within, or an acute angle, an under bevelling.

BILANDER, a name given in different parts of Eu-

rope to different kinds of vessels; but more particularly to those with a fore and aft mainsail, bent on a yard which has its peak considerably higher than the common fore and aft mainsail; and with the tack brought considerably before the main mast, and the sheet to the taffrail.

Bill (Swedish, *intappa*; Danish, *indpinde*; Dutch, *pennen*, *inpennen*; German, *pinnen*, *einpinnen*; French, *enter*; Italian, *indentare*; Spanish, *endentar*; Portuguese, *enxertar)* a part that projects to fit into a mouth or aperture, for giving strength or uniting two pieces so as to preserve them in one relative position.

Bill (see Anchor).

Bill-Plate (see Anchor Lining).

Bill-Board (see Anchor Lining).

Binding Strakes (309) (Swedish, *skårstockar*; Danish, *skierstockker*; Dutch, *schaarstokken*; German, *scheerstocken*, *oder scheerstroken des decks*; French, *hiloires*; Italian, *corde*; Spanish, *cuerdas*; Portuguese, *sicordas)* strakes that unite several parts in one continued mass, as the *binding strakes of the deck*, &c.

Birthing (see Planking).

Binnacle or Bittacle, a case for fixing the compasses, &c. in.

Bitts are square timbers fixed to the beams vertically and enclosed by the flat of the deck; they are for securing the cables to, and for leading principal ropes connected with the rigging, &c.

The Riding Bitts (Swedish, *beting*; Danish, *beting*, *eller beding*; Dutch, *beeting*; German, *beting dil grosse*; French, *les bittes*; Italian, *le bitte*; Spanish, *las bitas*, *o' abitas*; Portuguese, *as abitas)* are for securing the ship to when riding at anchor, and are placed upon the gun or lower deck of all two deck ships and upwards, and upon the upper deck of ships of smaller classes. Ships of 28 guns and upwards in general have two pair, below which they seldom have more than one pair, fixed to the aftside of the beam abaft the foremast; they extend from about four feet to five feet three inches above the deck, to which they are placed, to about four inches below the under side of the beam of the deck below, except in flush deck vessels, when they extend down to the foot-waling,

or timbers; they are of a parallel breadth to the lower side of the beam of the working deck, below which they are tapered on the aft side, and side and side, so as to be at the lower end one-sixth less, and are scored and faced upon the beams about one inch and a half. These bitts are bolted to each beam with two bolts, and when they extend down to the footwaling or timbers, they have one short bolt in each heel.

Upon the aft side of the bitts is fixed a timber called the *cross-piece* (Swedish, *betings-kalf;* Danish, *tvæbeting eller bedings-puden:* Dutch, *beeting-balk;* German, *betingbalken;* French, *traversin des bittes;* Italian, *stramazzo delle bitte, traversa del bitte;* Spanish, *cruceta de la bita;* Portuguese, *traversaom da abita*) lying horizontally, with its lower side, in three deck ships, one foot nine inches; in two deck ships, one foot eight inches; in frigates, one foot seven; and in sloops, one foot six inches above the deck. These timbers score and face upon the bitts from $1\frac{1}{2}$ inch to $2\frac{1}{2}$ inches, and extend to a certain distance without them on each side. They are confined to the bitts with an hook and eye; the hook is fastened to the bitts with a collar-headed bolt, and the eye passes through the cross-piece, and is clenched on the aft side.

The cross-piece is sustained by a shot locker, which is in general fixed under them; if not, by a bracket that is fastened to the side of the bitts, and projects aft sufficiently to support it.

To take the rub of the cable from the cross-piece, a face-piece from five to six inches is brought on the aft side of it, of elm, and fastened with treenails about 16 inches apart on alternate edges.

The face-piece is rounded off on the aft side, on the upper and lower edges, to a circle, the radius being equal to its thickness.

To give support to the bitts, where the ship is riding heavy, a knee called the *standard against the riding bitts* (Swedish, *betingsknän*; Danish, *betingknæer*; Dutch, *beetingsknien*; Germ. *betingsknien oder stockknien der beting*; Fr. *courbes des bittes*; Italian, *bracciuoli delle bitte*; Spanish, *curvas de las bitas*; Port. *curvas das abitas*) is placed against them. They are fayed in general upon a

carling, which was formerly about an inch below the upper surface of the beams, for the standard to score over them to act against the pressure forward; but now the carling is mostly fair with the upper surface, and the standard has two or three circular coaks in it and the carling.

The standard to the after bitts extends and forms an abutment against the foremost, and to the foremost bitts; a piece sometimes is worked to the height, and forms the mast partners, abutting against the foreside of the bitts, and extending to the fore part of the bowsprit partners. When this is the case, the standard is brought upon it, and has its fore end let into this piece about four inches, with an abutment to resist against the bitts. The standard has likewise two or three circular coaks in the piece upon which it is fayed, and has two bolts and one circular coak in each mast beam, and two circular coaks in each carling, abaft the mast beams. The arm of the standard connected to the bitts extends as high as the upper part of the cross-piece, and in the lower part of it, a hole is cut through for a stopper.

The standards are bolted with two bolts that pass through the bitts above the deck, one that stives below the deck, and one through each beam; others are likewise driven through the carlings, so that those before the one which passes through the beam, to which the bitts are connected, may be about 18 inches apart. The bolts are driven from above and clenched below.

Fixed to the fore side of the bitts, extending from the under side of the beam of the working deck, to the upper side of the beam below, is a cleat for preventing the bitts from working, two-thirds the breadth of the bitts, from 7 to 9 inches thick at the upper, and tapered to two-thirds the thickness at the lower part. This cleat is in general bolted with five bolts, one placed four and one eight inches from the upper end, and three at equal distances below. The bolts pass through the bitts, and the two upper are clenched upon the aft side.

Carrick Bitts (Swedish, *bradspelbeting*; Danish, *bradspilbeding*; Dutch, *braadspitbeting*; German, *bratspill-beting*; French, *les bittes latérales du vindas*; Italian,

le bitte del mulinello; Spanish, *las abitas del molinete*; Portuguese, *columnas das abitas do molinete*). These bitts are for fixing the windlass, and are therefore only to such ships as have them, where they answer every purpose of riding bitts. They are brought with their aft side to the center of the windlass, and extend from a sufficient height above the working deck, sometimes down to the footwaling, where their foreside is scored and faced upon the beam, and bolted through it with two bolts; at other times they are fixed to a carling, that is attached to the beams of the working deck. When this is the case, the carling takes two beams abaft the bitts, and two or three before, and is scored over and faced on each side of the beam about $\frac{1}{4}$ at the upper part, $\frac{3}{8}$ of an inch at the lower, or as much as the moulding at the lower part of the beam, if there is one, so as to be well with the lower part; and of a depth sufficient, so as to be $1\frac{1}{2}$ inches or 2 inches above the upper surface of the deck; and of a breadth, so as to be at least 3 inches on each side wider than the bitts, to support the caulking. The bitts have two tenons, each $\frac{1}{4}$ the size of the bitts fore and aft, and $\frac{4}{5}$ the size of them athwartship; the after tenon is brought to the after port of the bitt, and has its upper part taken off to form a dovetail; the foremost tenon is placed with its fore-part about $\frac{1}{4}$ the breadth of the bitts from their fore side; they let quite through the carling, and are both formed so as to dovetail on the aft side of the tenon, and are forced upon the dovetail by a key driven up from the under side on the foreside of each. The bitts let down their whole size into the carling, about two inches, so as to caulk round them. On the foreside of the carrick bitt is placed a knee, or standard to support them. If they run down, there are carlings placed to receive them, the same as to the standards against the riding bitts; but when the bitts are fixed in carlings, the standards are brought upon them. The standards are bolted up and down with one bolt through each beam and two between. The two bolts that pass through the gudgeon (see WINDLASS) answer for two of the fore and aft bolts, which are in general four in number.

To the aft side of the carrick bitts is fixed a cicular chock, with its lower end let into the deck about half an

inch and confined to the bitts, in general, by a strap, and the upper end by a nut and screw; sometimes both ends are secured to the bitts by nuts and screws. It is fastened in this or a similar manner, that it may be easily removed to take down the windlass.

Paul Bitts (Swedish, *palbeting*; Danish, *palbeding*; Dutch, *palbeeting*; German, *pal beting des bratspills*; French, *cadre de charpente et potence établie vers le milieu du vindas, où l'on établit les élinguets ou éliquets*; Italian, *le bitte delle castagne del mulinello*; Spanish, *bitas del pal del molinete;* Portuguese, *abitas dos linguetes, (ou do pal) do molinete).* The paul bitts are for fixing the main pauls of the windlass, and have therefore a great stress communicated to them; and they form one of the principal supports of the windlass when the ship is riding heavy.

These bitts run down or let into a deep carling, the same as the carrick bitts.

Topsail Sheet and Jeer Bitts (Swedish, *tvärbetingar;* Danish, *tvärbetinger;* Dutch, *kruisbeetingen*; German, *kleine-betingen, kreuz-betingen*; French, *bittons*; Italian, *bittoni*; Spanish, *abitones, escoteras*; Portuguese, *escoteiras).* These bitts are placed to the fore and main masts for bringing the topsail sheets and jeers to. The jeer bitts are placed on the aft side, and the sheet bitts on the fore side of the mast. The fore sheet and jeer bitts are placed on the forecastle. The sheet bitts are brought on the aft side of the beam before the mast, and extend down, and tenon into the mast partners on the upper deck; formerly these bitts, below the forecastle, were curved to meet at the middle, when they were called Y bitts. The fore jeer bitts are brought on the fore side of the beam, abaft the mast, and extend down, and bolt with two bolts to the upper deck beams: they have sufficient cast at the lower part for their midship side to clear the mast partners. Both the sheet and jeer bitts are scored and faced one inch upon the forecastle beams, and are bolted with two bolts in each.

In flush deck vessels, the sheet bitts are in general brought on the fore side of the beam, and bolted to the side of the bowsprit partners; and the jeer bitts are

formed by knees, which extend from the beams abaft to the beam before the mast.

These bitts have a cross-piece on their aft sides scored and faced one inch upon them, and bolted with two bolts in each bitt, punched up, and plugs driven upon them. The main jeer and sheet bitts, in most ships, are placed on the upper deck; the sheet bitts in general to the aft side of the after beam of the main hatch; and the jeer bitts to the fore side of the foremost beam of the after hatch. These bitts formerly tenoned into the quarter-deck beams, and were secured to them by a T plate, but now they are only five-sixths the height from the deck to the under side of the beam, and extend down three inches below the under side of the beam of the deck below; they score and face one inch upon each beam, and are bolted with two bolts.

The sheet bitts have a cross-piece on the fore and jeer bitts on the aft side. The cross-piece scores and faces one inch upon the bitts, and is bolted with two bolts in each. The bolts are punched considerably within the wood, and a plug driven upon them.

Sometimes bitts formed with knees are fixed on the fore and aft sides of the mizen masts; those before extend from the beam before the mast to the next abaft; and those abaft, from the beam abaft the mast to the next abaft; these knees are bolted with two bolts in each beam, and have a cross-piece on their aft sides scored and faced on the bitts, and bolted with two bolts.

Gallows Bitts (Swedish, *galge*; Danish, *galge*; Dutch, *galg*; German, *galgen*; French, *potence*; Italian, *potenzie*; Spanish, *guindaste*; Portuguese, *bonecas)*. These bitts are fixed in flush-decked vessels for stowing the booms upon; there are two pair; the after pair in brigs is placed on the fore side of the after beam of the fore hatch, and in corvettes on the aft side; which answers likewise for the main sheet bitts, and has a cross-piece fixed to them the same as the main sheet bitts to other ships. The foremost pair is on the fore side of the foremost beam of the fore hatch; these bitts extend down to the lower side of the lower deck beams, and have a cross-piece upon their heads, which they tenon into. The upper part of the

cross-pieces is in general five feet above the deck. These bitts are scored and faced upon the beams, and bolted the same as the jeer and sheet bitts.

Fore Brace Bitts. These bitts are on the aft side of the main mast, upon the quarter-deck, for bringing the fore, fore topsail, and fore top-gallant braces to, and other ropes. They are placed on the fore side of the beam abaft the mast, and as they do not extend to the deck below, a chock equal to the depth of the beam and of the same breadth, is bolted on the lower side of the quarter-deck beam with five or six bolts, to give a greater support to them. These bitts are made to incline aft, sufficient to lead the ropes fair when they lead aft, and are considerably wider athwartships than other bitts, for fixing shivers for fair leaders. They score upon the beam at the upper part, sufficient to incline them aft, and are bolted to the beam with three, and to the chock with two bolts. These bitts have a cross-piece on the aft side scored, faced, and bolted the same as the cross-piece to the other bitts.

Black strake (123) (see Strakes).

Blocks (Swedish, *stapel-block*; Danish, *stapel-blok*; Dutch, *stapelblok*; German, *stapel-block*; French, *tins*; Italian, *tacchj*; Spanish, *picaderos*; Portuguese, *picadeiras)* short pieces of timber upon which the structure is erected (14). There are several tiers, one above the other; the upper tier is of a thickness equal to the excess of thickness of the permanent keel over the temporary keel (94); the next down is equal to the thickness of the false keels; and the next, which is called the splitting-out cap, should not be less than seven or eight inches, and free from knots, that it may be easily split out when the ship is launched.

Block, the piece from which the figure-head is carved.

Fixed Blocks, are blocks fixed to the sides of the ship for leading principal ropes connected with the yards and sails, and for removing or transporting the ship. The principal blocks are the fore and main sheet, main tack and brace, transporting block, and blocks for catfalls. The fore tack is in general led on board through the fore transporting block. Other blocks are sometimes with kevel

heads, fixed against the side, abreast the main and fore masts, inside, for the main and fore lifts; and for the topsail haliards, sufficiently abaft the masts to clear the tops; and outside in relation to the mizen mast for the derrick and mizen jeers.

The fore sheet block is in general fixed when the ship is worked below, so as to be in an opening before the gangway. It is fair inside and out with the outer surface of the planking, and the outside laps upon the timber to the thickness of the planking two-thirds of its breadth, and if a port timber, it laps as far as the stops; two bolts are driven through each lap and clenched upon the inside planking. When worked above, a block is fixed horizontally upon the gunwale, and extends as far out as the outer part of the hammock stanchions, just before the gangway. The fore sheet block has in general two shives, one for the sheet and one for the studdingsail guy.

The main sheet block in two-deck ships was formerly brought to an outrigger, commonly called a spider, at the most convenient part abaft the main channel, and led into the port, and to prevent its rubbing against the stops a roller was fixed to the side; but now in all ships it is in general fixed in the quarter-deck barricading.

The main tack was formerly brought to the chess-tree, and led through the side by a block similar to the fore sheet, but now it is in general fixed to the most convenient place inside, to be worked above.

The main brace is sometimes brought to a spider fixed in the quarter piece, and led through a fixed block, placed as far aft as possible; at other times it is led directly through them. When there is only a rough-tree-rail, it is fixed in the space between the side counter and one of the rough tree timbers faying upon the plank sheer; but when there is a regular birthing, it is let through it, and its upper part is well with the lower side of the plank sheer.

It is of importance to the trimming of the main and fore courses that the blocks for the tacks and sheets should be properly placed, so that when the tacks are down and sheets home, the canvas may present as flat a surface as possible to the wind; and as it is known that for the impulse of the

wind upon the sails to produce the greatest effect in impelling the ship, when sailing by the wind, the yards should be braced to an angle of about 25° with the keel*; but this will be found considerably sharper than they can possibly be braced, on account of the shrouds and stays, which will not allow of their being brought nearer than about 30°, and that only with the trusses eased off considerably. Therefore, to place the blocks in the best position for the tacks and sheets, produce a line from about a foot from the diameter of the mast placed at an angle of 30° (or less if the yards can possibly be braced to it) with a fore and aft line, till it cuts the side of the ship, or if a spider is to be fixed in the side, to the outside of the spider; this will give the places for fixing the blocks, &c. which should be abided by as near as circumstances will admit of, bringing the tacks as near to the middle line as possible, as by this means they will be brought more directly down, according to the present breadth of the ship and length of the yards. The position of the fore end and length of boomkins will likewise be determined from this angle and the length of the foreyard produced from the foremast.

The block for bringing in the catfall is placed immediately over the cathead, between the timbers that are brought up on each side of it.

In the transporting blocks there are in general two shives placed opposite to each other in each block, for the warp to communicate with both, that it may be brought to act in any direction.

Board (Swedish, *bräde*; Danish, *dæle*; Dutch, *deel*; German, *diehle*; French, *bordage mince*; Italian, *tavola di poca grassezza*; Spanish, *tabla poca gruessa*; Portuguese, *taboinha*) distinguished from plank, from its being less than an inch and half in thickness.

Feather-edged Board, an inch or an inch and $\frac{1}{4}$ deal, sawed in two lengthways, in the direction of its dia-

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* See Chapman on finding the Proper Area of Sails, English Translation, p. 18; Euler's Theory of the Construction of Ships, English Translation, p. 247; Gower on the Theory and Practice of Seamanship, p. 20.)

gonal, so as to make two boards as near as possible their whole thickness on one edge, and as thin as possible on the other.

Boats (Swedish, *bat*; Danish, *baad*; Dutch, *boot*; German, *boot*; French, *bateau*; Italian, *batello*; Spanish, *barea*; Portuguese, *batel)* are small open vessels named and designed according to the purpose for which they are intended: they are impelled by oars or sails.

The principal boats for attending upon ships are launches, long-boats, barges, pinnaces, cutters, yawls, jolly boats, life boats, and gigs or galleys.

The launches, long boats, barges, pinnaces, and yawls, are carvel-built; and cutters, jolly boats, galleys, gigs, and life boats, are clincher-built.

The *Launches* are in general from 34 to 39 feet in length. They are for *watering* and carrying stores to the ship, and are sometimes armed and equipped for cruizing at short distances; they are mostly fitted to carry one twelve-pounder carronnade, and sometimes fitted with swivel stocks.

Long Boats (Swedish, *barkas*; Danish, *barkass*; Dutch, *barkass*; German, *barkasse*; French, *chaloupe*; Italian, *lancia*; Spanish, *lancha*; Portuguese, *lancha)* are seldom or ever employed for the use of British ships of war: they are sharper and wider than launches.

Barges are generally 32 and 35 feet in length. These boats are for accommodation, principally for carrying flag-officers and captains, and are lined and pannelled above the thwarts, all fore and aft, that they may be richly decorated if required.

Pinnaces are 28 and 32 feet in length. These boats are for similar purposes as the barges, but to carry officers of less rank; they are not therefore fitted up in quite so neat a style, as they are lined and pannelled no farther forward than the stern sheets.

Yawls are in length 26, 25, 18, and 16 feet. These boats are for carrying light stores, provisions, and passengers, to and from the ship. To the smaller class of ships, they answer all the purposes of a launch.

Cutters, *Jolly Boats*, *Galleys*, *Gigs*, and *Life Boats*, are clincher-built, that they may be made as light as

possible. Cutters are in length from 32 to 16 feet; they are used for various purposes that are common to ships' duty, though sometimes 32-feet cutters are supplied to ships instead of a barge and used for the same purposes; and sometimes the shorter boats are called and used as jolly boats. *Galleys* are from 28 to 36 feet in length; they are used in enterprises and expeditions against the enemy, and against illegal trade. *Gigs* are in length from 16 to 27 feet; they are for swift rowing, and are supplied to ships when light boats are required. *Life Boats* are from 16 to 22 feet in length; they are for landing in surfs, performing enterprises and boarding ships, and for saving men that fall overboard, in bad or such weather as would endanger the life of the crew, to use common boats; they are constructed as light as possible and fitted with air tubes of sufficient buoyancy to support the crew, &c.; and in the event of the sea filling them, they have valves in the bottom to allow the water to escape till it is on a level inside and out. The air tubes are made to fix and unfix, that the boats may be used as jolly boats.

Bolsters of Hawse are bolsters to take the rub of the cable from the cheek, and to prevent the angle of the hawse hole being formed too suddenly. They are sometimes above the upper cheek, and sometimes between the cheeks; they extend up about two-thirds of the hawse-hole, and when between the cheeks, they have a *filling* on them to fill up. They fay to the bow, and extend from the stem the whole length of the cheek, and their fore part projects beyond it from two to three inches; their fore end is cut to an angle from a thwartship line, so as to allow the hooding ends (96) to be caulked, and their after end is rounded off in the same manner as the cheeks.

They are bolted with six or eight bolts, driven through the bow and clenched; and to prevent them from injuring the cables, they are punched two or three inches within the wood, and short plugs put over them. There is an eye-bolt, with the eye up and down, driven between the two holes, nearly on a level with their upper parts, for clearing hawse, and sometimes it is used for a boomkin brace.

Bolsters for Tacks and Sheets are pieces formed to

a semicircle, and placed on different parts, to prevent the tacks and sheets from chafing.

Bolts (Swedish, *bultar*; Danish, *bolte;* Dutch, *bouten;* German, *bolzen*; French, *chevilles;* Italian, *perni;* Spanish, *pernos;* Portuguese, *cavilhas)* are cylindrical — or sometimes square (Swedish, *fyrkantige bult*; Danish, *fürkantige bolt*; Dutch, *vierkantige bolt*; German, *viereckantige bout*; French, *boulon, cheville quarrée*; Italian, *perno quadrato*; Spanish, *perno caudrado*; Portuguese, *cavilha quadrada)*; of metal, varying in diameter from ½ an inch to 2¼ inches, which are adapted according to the object they are intended to secure. They are for uniting in one mass the different parts of the structure, and are of various lengths according to the places where they are employed; the longest bolts through the deadwood may be about 17 feet, and the upper bolts through the knee of the head 19 feet.

These bolts are generally made of copper, iron, and what is termed a *mixed metal*, which is a composition of copper and zinc, with a certain proportion of grain tin, to give it a suitable degree of rigidity.

The copper is used below water (182), and the iron above; the mixed metal is used for minor purposes, as a substitute for copper.

Bolts are formed with different heads, according to the purposes for which they are used; they are distinguished into the common, saucer, collar, tee, and caulking-iron headed bolts; also they have sometimes conical heads. The *common head* is used for common purposes in uniting wood and wood; it is but a small swell beyond the iron. *Saucer-head* is a thin head, formed to about twice the diameter of the bolt: these heads are used in bolts that are intended for fastening iron plates to wood, and sometimes for driving into fir or any soft wood. The *collar-head* is similar to the saucer, excepting that it has greater substance in it as to thickness; bolts with these heads are used principally for bolting iron knees, they were likewise used formerly for bolting the standards of wood. The *tee-head* has rather more substance in it than the collar-head; it is nearly formed, with a segment of the circle of the head, taken off on each side, so as to make it one way half the size it is the other; the bolts having these heads are

for securing the chain plates, and are called chain bolts; they are formed in this manner for taking down the chain plates without driving them out. The *caulking-iron head* has rather more substance in it than the saucer, but less than the collar, and for a certain distance from the head the bolt has a somewhat conical form: these heads are formed in bolts that are intended principally to be driven in fir planking, and sometimes the knee of the head bolts are formed so: conical heads have but little projection, but the bolt to a certain distance from the head is conical; they are as a substitute for collar heads in iron knees, where the holes are formed to correspond, that the bolts may fit close in them. The length of the conical part is sufficient to extend some distance into the wood, to compress it and resist working.

When the bolts have to resist any strain in the direction of their length, the points of them are secured either by being rivetted, or clenched, or forelocked. The former is called a *clenched bolt* (Swedish, *klinkbultar;* Danish, *klinkbolte;* Dutch, *klinkbouten;* German, *klink bolzen;* French, *chevilles clavetées sur virole;* Italian, *perni ribattuti;* Spanish, *pernos rebatidos;* Portuguese, *cavilhas de aninar*); and the latter a *forelocked bolt* (Swedish, *slutningsbultar, splintbultar;* Danish, *slutningsbolte, splitbolte;* Dutch, *oogbouten met spylen;* German, *splint-bolzen;* French, *chevilles à goupille;* Italian, *perni à chiavetta;* Spanish, *pernos a chaveta;* Portuguese, *cavilhas de escatelar, ou de escatel, ou cavilhas catelares*). Short bolts are in general forelocked when they have a mortise made through the point, at right angles to the bolt; and when the bolt is driven, an iron wedge-like key is driven through it; behind the wood and key an iron ring is placed. Sometimes, when the bolts are not clenched or forelocked, but driven short, the points are barbed or jagged, that they may hold the firmer in the wood; they are then called *rag-pointed bolts* (Swedish, *tagbultar eller hackbultar;* Danish, *hakkebolte;* Dutch, *bouten met takken;* German, *tack bolzen;* French, *fiches, chevilles à grille ou à barbe;* Italian, *perni arponati;* Spanish, *pernos harponados, o niziembrados;* Portuguese, *cavilhas farpadas*): they are more commonly used in putting together the masts than the hull. The French and most other nations use them

more than the English. Bolts are sometimes pointed when they have to pass through holes that are not straight, or through openings, and when they are to fasten any iron work, as knees, &c. as the hole in the iron is frequently not in the same direction as that in the wood. The long bolts through the knee of the head and deadwood are *pointed bolts* (Swedish, *skarpbultar;* Danish, *skarpbolte;* Dutch, *scherpe of spitse bouten;* German, *scharf-bolzen;* French, *chevilles à pointe aigue;* Italian, *perni con punta acuta;* Spanish, *pernos de punta aguda;* Portuguese, *cavilhas de ponta aguda*).

Eye Bolts (Swedish, *ögnebultar;* Danish, *öjebolte;* Dutch, *oogbouten;* German, *aug bolzen;* French, *chevilles à œillet;* Italian, *perni a occhio;* Spanish, *pernas de ojo;* Portuguese, *cavilhas de olhal*) are bolts that have an eye formed upon one end, to project out for hooking tackles, lashing the guns, &c. When over the ports for lashing the guns, they are called *muzzle lashing bolts;* when between the ports through the side, *intermediate*, and at the ports, *gun tackle eye bolts*. The top tackle eye bolts are those for the top tackles. When the eyes have to resist particular strains not in the direction of their length, they are formed with shoulders that rest upon a plate, to prevent their being forced into the wood, as the fish tackle eye bolts, &c.

Hook Bolts (Swedish, *hakebultar*; Danish, *hagebolte*; Dutch, *haakbouten*; German, *haken bolzen*; French, *chevilles à croc*; Italian, *perni a gancio*; Spanish, *pernos de cancamo*; Portuguese, *cavilhas de gato*) are in general for the same purpose as the eye bolts, but mostly used by the French and other nations.

Ring Bolts (Swedish, *ringbultar;* Danish, *ringbolte;* Dutch, *ringbouten;* German, *ring-bolzen;* French, *chevilles à boucle;* Italian, *perni a anello;* Spanish, *pernos de argolla;* Portuguese, *cavilhas de arganeo*) have a ring turned into the eye. These bolts are for different purposes; as for the stopper for the cable, called stopper bolts; for the breeching of the guns, called breeching and preventer breeching bolts; for training the guns, &c. called train tackle bolts. When the rings are intended for lashing, they are of a triangular form, that the lashing may lie easy.

Fix Bolts are the ring and eye bolts that are fixed for different purposes, as the eye bolts for the standing parts of sheets and tacks, &c.

Starting Bolts or *Drift Bolts* (Swedish, *jagbult*; Danish, *drivbolte at drive bolter ud med*; Dutch, *stempel-bout*; German, *stempel bolzen*; French, *rebousse*; Italian, *sportadore*; Spanish, *botador*; Portuguese, *botador*) are used for driving out others.

Wrain Bolts, ring bolts that forelock. They are in general placed through the treenail holes and fore-locked, and have cylindrical pieces of wood, called wrain staves, placed through the ring, for the purpose of setting to (called bring to) by means of wedges, the different planks to the frame of the ship, &c.

Bomb Vessel (Swedish, *bombkits*; Danish, *bom-barder-galiot*; Dutch, *bombardeer galjoot*; German, *bom-bardier galiote*; French, *galiotte à bombes*; Italian, *ga-leotta da bombe*; Spanish, *bombarda*; Portuguese, *galiota de bombas*) a small vessel of war designed to throw shells from mortars into a fortress. These vessels, which are intended for vigorous bombardments, and have to sustain the shock produced by the discharge of the mortars, have an extra degree of strength given them, especially immediately under the mortar beds.

Boomkin, or Bumkin (Swedish, *bottlof*; Danish, *botteluur eller boutteluer*; Dutch, *botloef*; German, *but-luf*; French, *minois, portelof, boutelof*; Italian, *minotto, mijotto, o grua per amurare il trinchetto*; Spanish, *servio-letta*; Portuguese, *pao da amura do traquete*) is a boom that is fixed to the bow of the ship for hauling down the fore tack; it is secured either by a tenon or a cleat against the bow, and rests upon the false rail, or a cleat for the purpose, with a strap over it. There is in general a collar-headed bolt that passes through the strap, boomkin, and rail, and forelocked on the under side of the rail, and one bolt driven into the bow. The boomkin should be placed so that the fore end and the fore mast should form a suitble angle (about 25°) with a fore and aft line, at a proper distance before the mast (rather more than half the length of the yard) and sufficiently down, that when the fore tack is aboard, the fore sail may be well down (see Fixed Blocks).

Booms (Swedish, *svängbommer*; Danish, *sväng-bommer*; Dutch, *loefboomen*; German, *luv-bäume*; Fr. *boute-hors*; Italian, *pescanti*; Spanish, *pescantes*; Portoguese, *bimbarras*) poles or outriggers for extending or hauling out different sails, &c. as *Main Boom* or *Driver* (442) *Boom* (Swedish, *bommen af et bomsegel*; Danish, *bommen til et brigseil*; Dutch, *geip boom*; German, *giek baum*; French, *gui au baume*; Italian, *boma*; Spanish, *fotebarra*; Portuguese, *bome*): *Jib Boom* (454) (Swedish, *klysvarebom*; Danish, *klyverbom*; Dutch, *kluiverboom*; German, *klüver-baum*; French, *bâton de foc ou boute-hors de beaupré*; Italian, *bastone di focco*; Spanish, *botalon del baupres, batalon de foc*; Portuguese, *pao da boyarrona*): *Studdingsail Boom* (458) (Swedish, *läsegels bommar*; Danish, *lœsesejls-spirer*; Dutch, *ly-zeils-spieren*; German, *leesegal-spieren*; French, *boute-hors de vergue, boute-hors de bonnettes*; Italian, *bastoni o lancialuoli dei cortellazzi e scopamare*; Spanish, *botalones*; Portuguese, *botalos*): and booms for booming off, called *Fire Booms* (Swed. *brandhakar*; Danish, *brandhage*; Dutch, *brandhaken*; German, *brandhaken*; French, *boute-hors pour defendre l'approche des brûlots*; Italian, *bastoni per impedire l'abbordaggio d'un brulotto*; Spanish, *perchas para defender el abordaje de un brulote*; Portuguese, *paos para defender a abordagem de hum brulote.*

The *main boom* is for extending the fore and aft mainsail; the *jib boom* for the jib; a boom is likewise connected with this called the *flying jib boom* (455), for the flying jib. The *studding sail booms* are the fore and main lower, top and top-gallant studding sail, and sometimes swing booms for bearing out the lower studding sails (see Mast Making.)

Bow (Swedish, *bog*; Danish, *bov eller boug*; Dutch, *boeg*; German, *bug des schiffs*; French, *l'avant du vaisseau relativement à sa construction*; Italian, *la prua*; Spanish, *la proa*; Portuguese, *proa avante*) the curved part of the body forward from the stem to the loof, or where the curve more suddenly approaches a fore and aft line.

Full or *Bluff Bow* (Swedish, *fyllig bog, tvär bog*; Danish, *rund bov*; Dutch, *volle boeg*; German, *voller*

bug; French, *avant renflé, avant joufflu*; Italian, *prua piena*; Spanish, *navio muy lleno de proa*; Portuguese, *navio muito cheio de proa)*. In proportion as the horizontal tangent to the curve of the bow approaches a perpendicular to the longitudinal axis, the bow is said to be full, or very full.

Lean or *Sharp Bow* (Swedish, *skarp bog*; Danish, *skarp bov*; Dutch, *scherpe boeg*; German, *scharfer bug o der schmaler bug*; French, *avant maigre*; Italian, *prua magra o acuta*; Spanish, *chupado de proa*; Portuguese, *proa agucada)*. In proportion as the horizontal tangent to the curve of the bow approaches a fore and aft line, or forms more acute angles with the longitudinal axis, the bow is said to be sharp, or very sharp, or lean.

Flairing Bow (Swedish, *springande bog*; Danish, *bogen af et skib som skyder forud*; Dutch, *een vooruitschietende boeg*; German, *ein springender, oder vorübershäugender bug*; French, *avant fort élancé*; Italian, *proa che a molto lanciamento*; Spanish, *proa que tiene mucho lanzamento*; Portuguese, *proa que tem muito lancamento*). The bow flairs more or less as it falls out or increases in breadth at the upper part, and it rakes in degrees, as it is without a perpendicular vertically to the longitudinal axis; when it is perpendicular, the bow or stem is said to be upright.

Bowsprit (Swedish, *bogspröt*; Danish, *bougspryt eller bovspryt*; Dutch, *boegspriet*; German, *bugspriet*; French, *beaupré*; Italian, *copresso, buonpresso*; Spanish, *baupres*; Portuguese, *gurupes)*. The bowsprit (364) is for securing the foremast and for extending the head sails.

Bowsprit Chock (Swedish, *sluthult*; Danish, *slutholt*; Dutch, *slothout van de boegspriet*; German, *schlosholz oder schlotholz des bugspriet*; Fr. *petite pièce de bois placé entre les apôtres au-dessus du beaupré*; Italian, *chiave sul copresso*; Spanish, *entre miche sobre el baupres*; Portuguese, *chasso sobre o gurupes)* a chock placed between the knight-heads, (32) fitting close upon the upper part of the bowsprit, when the planking above is not carried round, but abuts against the boxing of the knighthead. This chock in general laps upon the fore part, and is bolted through the knight-heads.

Boxing. The boxing is any projecting wood, as the boxing for the gripe to abut against, boxing of the knight-heads, post timbers, &c. (Note 8).

Boxing Scarph (27) (see Scarph of the Stem).

Brackets, pieces resembling knees, with their outer parts formed in general with an inflected curve; they are either for support or ornament.

Hair Bracket, a piece which is a continuation of the upper cheek, and terminates with a scroll at the back of the figure of the head.

Console Bracket, frequently called a canting-livre, is a carved ornament placed at the fore part of the quarter gallery.

Stern Brackets are carved ornaments placed upon the munions where the cove springs from.

Brakes (Swedish, *pumpvipp*; Danish, *pompvippe*; Dutch, *gekstok*; German, *geckstock oder geck der pumpe*; French, *bringuebale*; Italian, *manovella della tromba*; Spanish, *guimbalete*; Portuguese, *embalete)* the handles or levers for working the hand pumps.

Breadth extreme (Swedish, *skeppets bredden*; Danish, *skibets breden*; Dutch, *breedte vont schip*; German, *breite eines schiffs*; French, *largeur d'un vaisseau*; Italian, *bocca della mare*; Spanish, *mauga*; Portuguese, *boca)* is one of the principal dimensions of the ship; it is the widest part to the outside of the plank of the bottom without the timbers, whereas the breadth moulded is only to the outside of the timbers.

Break, when the quarter deck or forecastle has a rise to give height between the decks; the parts where the rise terminates towards the waist is called the break of the quarter-deck or forecastle.

Bread Room (Swedish, *brödskafferi*; Danish, *bröd-rommet*, *brödkammer*; Dutch, *broodkamer*; German, *brodkammer oder brodschafferel*; French, *saute à pain ou au biscuit*; Italian, *pagliotto, o paglinolo a biscotto*; Spanish, *panol del pan*; Portuguese, *paiol do biscouto)* a place parted off for receiving the bread, at the after extremity of the ship. It is from the keelson to the upper deck in flush-deck vessels, in all others to the lower deck. The bread rooms are always lined over. A dunnage batten

about half an inch in thickness is first placed up and down upon the footwaling or timbers, and a feather-edged board with the thick edge upwards fastened longitudinally upon it. The upper part of the crutches, &c. are lined over in the same manner, but their sides are mostly lined with slit or plain deal.

BREAM (Swedish, *brimma et skepp. svåda och brånna et skepp med halm eller rö uti kölhalning*; Dan. *svide og brænde et skib med halm eller rör udi kiölhaling*; Dutch, *een schip branden sengen*; German, *ein schiff brennen*; French, *chauffer un vaisseau, donner le feu*; Italian, *dar il fuoco alla nave*; Spanish, *dar fuego al costado del navio*; Portuguese, *queimar hum navio)*. The operation of breaming is to clean from the bottom, the sea-weed, ooze, or any filth that may have accumulated upon it, by means of furze, reeds, faggots, or similar materials, kindled and held to the bottom. The flame communicates with the pitch, or other combustible substance with which the bottom is payed over, and loosens whatever has adhered to it, so that it may be cleaned off.

This operation is in general done on floating stages as the water leaves the ship. Previous to its being done, fire engines are placed alongside, in case of any part taking fire, and to wet the upper works. The ports, scuttles, scuppers, &c. are stopped up, and the joints covered with clay, or some substance impervious to fire, to prevent its communicating with the internal part.

Breaming now seldom takes place, as it is not necessary when the bottom is coppered.

BREAST WORK (Swedish, *skott*; Danish, *skod*; Dutch, *schot*; German, *schott, schot oder schotting*; Fr. *cloison, fronteau*; Italian, *parapetto*; Spanish, *mamparo*; Portuguese, *antepara)* is formed of rails and newells; the rails (called the breast rails) are formed of different curves, and their edges worked with different moulding; and the newells are frequently worked with different members, as with a cap, frieze, and necking, and shaft socket and plinth; the whole was formerly decorated, and is now in yachts, with different emblems. The breast-work used to form in ships of war a balustrade at the termination of the *Quarter Deck* (Swedish, *skott för skansen*; Danish,

skod for skandsen; Dutch, *schot van de stuurplegt*; German, *schott der schanze*, *schott der steuer pflicht*; French, *fronteau du gaillard d'arrière*; Italian, *parapetto del cassaro*; Spanish, *mamparo del alcazar*; Portuguese, *parapeito-da tolda*): *Forecastle* (Swedish, *backens ackter-skott*; Danish, *bakkens agter-skod*; Dutch, *henne-schot*; German, *henne schott oder hintere schott der back*; French, *fronteau arrière du gaillard d'avant*; Italian, *parapetto del castello dietro*; Spanish, *mamparo á la subida del castello*; Portuguese, *parapeito do castello de prou arré*): and *Round-house* or *Poop* (Swedish, *skott til hyttan*; Danish, *hytte-skod*; Dutch, *schot voor de hut*; German, *schott der hutte*; French, *fronteau de la dunette*; Italian, *parapetto del cafferetto*; Spanish, *mamparo de la toldilla*; Portuguese, *parapeito do tombadilho*).

BREAST RAIL (see RAILS).

BREACH, where the outside of two arms of any pieces formed of knee timber meet, or the angular part, as the breach of the transoms where they coincide with the post or inner post, or floors where they coincide with deadwood, &c.

BRIDGES or BEARERS, pieces placed across in binns and lockers for supporting the lids; they are in general dovetailed into the front to prevent their being forced out.

BRIG (Swedish, *brigg*, *bergantin*; Danish, *brig*; Dutch, *brig of brigantyn*; German, *brig oder brigantine*; French, *brigantine*; Italian, *brigantina*; Spanish, *bergantin*; Portuguese, *bargantim*) vessels having two masts rigged similarly to the fore and main masts of ships, and a fore and aft mainsail. This term is often applied by seamen of different nations to vessels peculiar to their own marine, and not confined to the manner in which they are masted and rigged in the British service.

Brig Cutter (Swedish, *brigkutter*; Danish, *brigkutter*; Dutch, *brigkutter*; German, *brigkutter*; French, *un cutter gréé en brigantine*; Italian, *una balandra con guarnimento d'una brigantina*; Spanish, *balandra con aparejo de un bergantin*; Portuguese, *chalupa com aparelho de hum bargantim*) cutter-built vessels rigged as brigs.

Bucklers are lids or shutters for closing the hawse holes, to prevent the encroachment of the sea through them, when the ship is pitching. They are in general of elm, with grooves in them, fitting close over the laps of the hawse pipes. When in one, they are called blind bucklers, and are used when the cables are unbent; and when in two, riding bucklers, in which case they rabbet in the middle, at half the hole up, and have a hole in them to fit close round the cable, and are used when riding at anchor, or when the cables are bent. They are fixed between cants that circumscribe about three inches clear of the holes, called buckler cants. These cants are fastened to the bow of the ship in general with nails, and the edges of the bucklers fix close between them. The bucklers when in use, are fixed in their place sometimes by two bars to each hole, that tenon into the hook above and chase into the one below; between these bars and the bucklers, wedges are in general driven to press them firm to the bow. At other times, especially when there is an iron hook below the hole, there is an iron plate fixed to the upper part of the buckler, which when they are fixed goes about three inches into the hook above, and two plates with eyes in their lower end below, which are placed over eyes fixed in the cant through which an iron bolt passes.

Builge or Bilge, the full part of the ship's body on each side the keel at the floors, or that part which would be in contact with the supporting surface, if aground.

Builge trees, frequently called builge pieces or builge keels. Pieces sometimes brought longitudinally on the builge of small vessels or boats, to prevent their falling to leeward, and to keep them upright when they take the ground.

Builge ways (Swedish, *sladarne*; Danish, *slädebalker*, *aflöbnings-puder*; Dutch, *sledebalken*; German, *schlittenbalken*; French, *coites*, *anguilles*; Italian, *vasi*; Spanish, *anguilas de cuna*; Portuguese, *cachorras*) a timber placed on each side of the ship to form the cradle upon, for supporting the body when descending the inclined plane in launching. The builgeways are in general about from 0.8 to 0.85 of the length on the deck, and are in breadth about one inch in six feet of their length; if

they have plank brought upon each side, they are less in depth by the thickness of the plank on one side. They are formed with the main piece of fir, scarphed together with scarphs about 10 feet in length, with the lips about 3 inches in thickness, and let in flush. The scarphs have four circular coaks in them, and are bolted with eight bolts; one bolt in each lip is driven from the lip side and clenched on the main piece; the remaining bolts, when the side pieces are brought on, are driven through, from each side alternately, and clenched upon the side pieces. These pieces are of oak plank from 3 to 4 inches in thickness, with the different lengths, where they abutt, billed into each other; they are treenailed and nailed to the main piece. At the lower part, a plank of 3 or 4 inches in thickness is brought on called the sole: this plank is fastened with nails, with their heads driven considerably within the wood. The different lengths of the sole where they abutt have their abutments cut to an angle of 45° or mitre, and placed with the butt of the after plank lying over the foremost one, to prevent the possibility of their catching as they descend. The upper and lower end of the builgeways are rounded at the lower part, and holes athwartships are cut through their ends for making the builge-rope fast, for getting the ways out after the ship is launched. Upon the outside of the fore end of the builgeways is fixed a cleat, called the dog cleat, for placing a shore against, called the dog shore, to prevent the ship from descending before it is intended. This cleat is kept up from the lower part of the builgeways at its after end, at least an inch and half more than the depth of the ribband at the deepest part from the lower side of the builgeways, and the fore end up so as to place it as near as possible in the direction of the dog-shore; it has two circular coaks in the side of the builgeways, and is bolted with four to six collar-headed bolts forelocked. The after end is cut off up and down, so as for the dog-shore, sweeping down, to forsake at the lower end at least a quarter of an inch (See Launch).

Bulkheads (Swedish, *gäflingar*; Danish, *gevelinger*; Dutch, *gevelingen*; German, *gemelingen*; Fr. *cloisons*; Italian, *casse sotto la coperta*; Spanish, *arcadas*;

Portuguese, *anteparas)* are partitions that separate one part of the ship from the other, and form the several cabins for the accommodation of the officers, and the store rooms for keeping distinct the different stores. The *bulkheads that lie across the ship* (Swedish, *tvärskotten*; Danish, *tvæskaaderne i rummet;* Dutch, *dwars schotten;* German, *dwars-schotten im raum;* French, *cloisons qui traversent le vaisseau;* Italian, *parapetti;* Spanish, *mamparos;* Portuguese, *parapeitos no poraom)* in the hold are in general from two to three inches in thickness; those that form the magazine, and spirit and bread rooms, to keep the powder, spirits, &c. more securely from the other stowage, have the edges of several breadths of plank in general rabbetted; and those that form the coal hole, well, shot locker, &c. are in general cypher-edged, to prevent, in the coal hole, the coals from working through the edges, and at the other places to keep the dirt from getting in; therefore in the coal hole the upper planks should have their upper edges over the lower, outside, and the other bulkheads inside.

The carpenter, gunner, boatswain, and captain's wardroom, with the marine store rooms, slop room, &c. are in general built up with 1¼ rabetted deals; and sometimes bulkheads that separate the wings are formed of lattice-work; they are then called *Lattice Bulkheads* (Swedish, *trall-skott;* Danish, *sköd af rostværker;* Dutch, *traalie-schot;* German, *tralje schott*, *schott von rosterwerk;* French, *cloison à jour;* Italian, *parapetto da quartieri;* Spanish, *mamparo da jareta;* Portuguese, *parapeito de xadrezes)* and are formed of battens nailed across each other so as to form squares or diamonds. The bulkheads upon the deck, that separate the officers' cabins, are in general formed by pannels or pieces of framing; the pannels are of inch, or what is commonly called whole deal, with three breadths jointed and glued together; they are for bulkheads where the appearance is not so much studied. Framing may be bead and flush, flat or raised-pannel, according to the place where it is fixed; each piece of framing is composed of stiles, rails, pannels, and sometimes munions; the stiles are those pieces that form the boundary two ways, or the up and down pieces, which

extend the whole length from the top to the bottom; the rails lie across, and are tenoned into the stiles; these are the upper, lower, and middle; if four, the next to the top is called the frieze rail. The pieces that fill in between the rails and stiles are called pannels, the upper one, between the frieze and top rail, is called the frieze pannel. When the pannels would be too large, or out of proportion to fill in wholly between the stiles, pieces are placed between them in the same direction, and tenoned into the rails called munions. Sometimes each piece of framing is fixed between thick pieces that tenon into the beam and deck, with rabbets out of their edges to receive the framing called thick stiles; these stiles are always placed on each side of the doors, and sometimes have on each side or face of them a pilaster with a cap and base for ornament. The pieces of framing should have as small a bearing as possible where they come in contact with the cant or deck below, and cant and beam above, and should be formed to a curve, which is called rockering, that when the ship works they may make as little noise as possible.

Burthen (see Tonnage).

Butt, the root or largest end of any timber or plank.

Butt, the joint where the different planks meet endways; likewise the space left between two butts for driving the oakum in. This space is left, because if the butts were close, it would be impossible to drive in sufficient oakum to produce a proper degree of compression.

Buttocks (Swedish, *lăring;* Danish, *gattet af et skib eller laaringen;* Dutch, *billen;* German, *billen des schiffs;* French, *les fesses*; Italian, *il rotondo della poppa*; Spanish, *cojenadas;* Portuguese, *alhetas)* the after part of the ship on each side below the margin of the wing transom, or to a certain distance above or below the superior flotation; above, till the longitudinal vertical sections begin to approach a vertical line, and below an horizontal. As these parts are more or less prominent, or have greater or less degrees of convexity, the ship is said to have lean or full buttocks.

Cabins (Swedish, *kajuta*; Danish, *kahyt*; Dutch, *kajuit*; German, *kajüte*; French, *chambre*; Italian, *camera*; Spanish, *camura*; Portuguese, *camara)* apart-

ments or *Cabins* (Swedish, *hyttor*; Danish, *kammerne*; Dutch, *kaamers*; German, *kammern eines schiffs*; French, *chambres*, *cabanes*; Italian, *camerini*, *camerotti*; Spanish, *camarotes*; Portuguese, *camarotes)* separated from the ship's company for the accommodation of the officers.

CAMBERING, an hollow or arching upwards, contrary to sheer or hanging.

CANT (Swedish, *kantra*, *wältra öfverända;* Danish, *kantre;* Dutch, *kantern;* German, *kantern;* French, *tourner ou renverser;* Italian, *rovesciare*, *tornare*, *voltare;* Spanish, *voltar*, *tornar;* Portuguese, *voltar)* any thing that lies oblique, as the plane of the sides of the *Cant Timbers* (Swed. *kantrings-timmer;* Dan. *spanter som ikke staæ ret paa kiölen;* Dutch, *hoek-spanten;* German, *hukspannen;* French, *couples dévoyés;* Italian, *quaderni che non stanno dritto ful primo;* Spanish, *cuadernas que no estan perpendicularmente sobre la quilla;* Portuguese, *balizas que naom estan perpendicularmente sobre a quilha)* which though perpendicular to the keel vertically, are horizontally oblique to the plane of elevation. The timbers are canted at each extremity, to bring the plane of their sides nearer perpendicular to the body. As far as these timbers extend forward is called the fore cant, and aft, the after cant body; and the part between these bodies, where the plane of the sides of the timbers is athwartships, is called the square body. This division of the different bodies can only take place as far as it respects the frame of the ship.

CANT SPARS (see SPARS).

CAPS (see BLOCKS upon which the ship is built).

Caps for the Mast-head (Swedish, *eselhufvud*; Danish, *æsels-hoved*; Dutch, *eezels-hoofd*; German, *eselshaupt*; Fr. *chouquet ton*, *tête de more*; Ital. *testa di moro*; Span. *tamborete*; Port. *pega)* pieces fixed upon the different masts (384) and topmasts (402), and bowsprit (388), for the topmast, topgallant masts, and jib boom to pass through. They are distinguished into the *Main Cap* (Swedish, *stora eselhuvud*; Danish, *store æsels-hoved*; Dutch, *groot ezelshoofd*; German, *grosse eselshaupt*; French, *chouquet du grand mât*; Italian, *testa di moro di maestra*; Spanish, *tamborete mayor*; Portuguese, *pega*

do mastro grande) which is placed on the head of the main mast: *Fore Cap* (Swedish, *fock-eselhuvud*; Danish, *fokke æsels-hoved*; Dutch, *fokke ezelshoofd*; German, *fock-eselshaup*; French, *chouquet de misaine*; Italian, *testa di moro di trinchetto*; Spanish, *tamborete de trinquete*; Portuguese, *pega de traquete)* on the fore mast: *Mizen Cap* (Swedish, *besan eselhuvud*; Danish, *besan æsels-hoved*; Dutch, *bezaans-ezelshoofd*; German, *besahns-eselshaupt*; French, *choquet d'artimon*; Italian, *testa di moro di mezzana*; Spanish, *tamborete de mesana*; Portuguese, *pega da mezena*) on the mizen mast: and *Bowsprit Cap* (388) (Swedish, *bogspröts eselhuvud*; Danish, *bougsspryts æsels-hoved*; Dutch, *ezelshoofd op de boegspriet*; German, *das eselshaupt des bugspriets*; French, *chouquet de beauprés*; Italian, *testa di moro del copresso*; Spanish, *tamborete de baupres*; Portuguese, *pega do gorupes)* on the bowsprit. For the topgallant mast to pass through (402), there are the *Main Topmast Cap* (Swedish, *store stäng-eselhuvud*; Danish, *store stænge æsels-hoved*; Dutch, *ezelshoofd op de groote steug*; German, *das grosse steugen-eselshaupt*; French, *chouquet du grand mât de hune*; Italian, *testa di moro di gabbia*; Spanish, *tamborete del mastelero de gabia*; Portuguese, *pega do mastareo grande)*, *Fore Topmast Cap* (Swedish, *för stänge eselhuvud*; Danish, *fore stænge æsels-hoved*; Dutch, *ezelshoofd op de voor-steng*· German, *das vorstengen-eselshaupt*; French, *chouquet du mât de hune d'avant*; Italian, *testa di moro di parochetto*; Spanish, *tamborete del mastelero de velacho*; Portuguese, *pega do mastareo de velacho)*, and *Mizen Topmast Cap* (Swedish, *kryss-stäng eselhuvud*; Danish, *kryds-stænge æselshoved*; Dutch, *ezelshoofd op de kruis-steng*; German, *das kreuzstengen-eselshaupt*; French, *chouquet du perroquet de fougue*; Italian, *testa di moro di contramezzana*; Spanish, *tamborete de sobre mesana*; Portuguese, *pega do mastareo de gata*). (see 384 to 390).

Capstan (Swedish, *spel gångspel*; Danish, *spil*; Dutch, *spil*, *gang-spil*; German, *spill*, *gang-spill*; French, *cabestan*; Italian, *argano*; Spanish, *cabrestante*; Portuguese, *cabrestante*) a machine used for extraordinary effort, as weighing the anchor, &c. It is of the same

mechanical advantage as the wheel and axle. Capstans are either single or double; single capstans are fixed on board all flush-deck vessels, and are either fixed upon an iron spindle, which is the case to the smaller class of these vessels, or have their barrels (which will be explained hereafter) extending to the deck below that upon which the capstan is fixed, where a step is placed to receive it, and the barrel, which is then conical below the deck, works on a pivot in an iron cup or socket.

The double capstans are fixed in all ships with a quarter-deck and forecastle; but ships of the line have two, called the main and fore *Jeer Capstans* (Swedish, *för spelet*; Danish, *for-spillet*; Dutch, *voor-spil*; German, *kleine gang-spill, vor spill*; French, *petit cabestan*; Italian, *argano piccolo, argano di prua*; Spanish, *cabrestante sencillo*; Portuguese, *cabrestante avante da esotilha grande)*: these capstans are composed of several pieces united strongly into one body; the principal piece that extends through both capstans is called the *Barrel*, and has the pivot formed of an *Iron Spindle* (Swedish, *gängspellets-tapp*; Danish, *spillets-tap*; Dutch, *pen van de spil*; German, *pinne des gangspills*; French, *pivot du cabestan*; Italian, *anima dell'argano*; Spanish, *peon del cabrestante*; Portuguese, *piaom do cabrestante).* The piece that fixes upon the upper part of the barrel to the upper capstan, to fix the bars in, is called the *Drumhead* (Swedish, *gängspels-hufvud*; Danish, *spil-hoved*; Dutch, *kop van de spil*; German, *kopf oder köppels des gangspills*; French, *la tête du cabestan*; Italian, *testa dell'argano*; Spanish, *cabeza del cabrestante*; Portuguese, *cabeca do cabrestante*): to the lower capstan, the *Trundlehead*; and that to which the pauls are fixed, which is only to the *Main Capstan* (Swedish, *stora gäng-spelet*; Danish, *agter-spillet, dobbelt spil*; Dutch, *dubbelde spil, spil boven en onder*; German, *doppelte gang-spill, hintere gang-spill, grosse gang-spill*; French, *cabestan double*; Italian, *argano doppio*; Spanish, *cabrestante doble*; Portuguese, *cabrestante aré do mastro grande)*, is called the ***Paul-head.*** The pieces that lie in the direction of the barrel, and round which the turns of the rope pass, are called the welps (Swedish, *spel-klampar, spelhvalpar*; Danish, *spil-klamper, spil-hvalper*; Dutch, *klampen van de spil*;

German, *spill-klampen oder gang spill-klampen*; French, *taquets de cabestan au flasques*; Italian, *funtinetti dell'argano*; Spanish, *guarda-infantes*; Portuguese, *cunhas do cabrestante*). Between the welps, at the upper and lower parts, are short pieces called chocks. The pieces at the deck, between the capstans, which circumscribe the barrel, and keep the capstan in an erect position, are called the *Partners* (Swedish, *gangspels fifkar*; Danish, *gangspillets fifker*; Dutch, *fiffer van de gangspills*; German, *fischen des gangspills*; French, *etambrais du cabestan*; Italian, *fogonature dell'argano*; Spanish, *fogonaduras del cabrestante*; Portuguese, *eunoras dó cabrestante*): and the piece at the lower part, into which a cup is fixed for receiving the iron spindle that is fixed in the lower end of the barrel for forming a pivot, is called the *Step* (Swedish, *spelspar*; Danish, *spil-spor*; Dutch, *spil-spoor*; German, *spillspuhr*; French, *carlingue de cabestan*; Italian, *mortaletto*; Spanish, *castanneta del cabrestante*; Portuguese, *carlinga au chapa do cabrestante)*. The barrel, which is of oak, is the main piece of the capstan, and is the piece to which all the other parts are fixed. To double capstans it extends from $5\frac{1}{2}$ inches into the drum-head to the lower part nearly of the paul-head; and from the lower part of the tenon at the upper end to two inches above the upper part of the partners, it is formed with ten or twelve squares, according to the number of welps, from two inches above the partners to about its diameter down, cylindrical, and from thence to the lower tenon it is formed with ten squares. The tenon at the upper end of the barrel is square, to fix into the drumhead, and is inscribed within the decagon or dodecagon, according as the barrel is formed, in length from $3\frac{1}{2}$ to 5 inches; and with an iron hoop driven upon it, in breadth equal to its length. Below the tenon there is another hoop about $2\frac{1}{2}$ inches wide, of the form of the barrel, with its upper edge well with the lower part of the tenon, and its outer part flush with the outer part of the barrel. The lower tenon is likewise formed square, which is inscribed within the decagon or form of the lower part of the barrel; upon the lower end of this tenon is brought an iron plate, of about one inch and $\frac{1}{4}$ to one inch and $\frac{3}{4}$ in thickness, that lets

over the square necking of an iron spindle which is driven into the lower end of the barrel, to form the pivot for the capstan to turn upon; this plate is bolted with four bolts, countersunk in the plate, and driven into the end of the barrel. Upon the tenon, with its lower edge well with the lower part of the plate, is driven a hoop from 5 inches to $5\frac{1}{2}$ broad, and from $1\frac{1}{4}$ inches to $1\frac{3}{8}$ in thickness. The iron spindle extends about two feet into the barrel, and below it from 5 to $7\frac{1}{2}$ inches; the part that fixes in the barrel is from $4\frac{1}{4}$ to $5\frac{3}{4}$ inches in diameter, and has a bolt that passes through it and the barrel about 3 inches from the end. The square necking left upon the spindle is from $1\frac{1}{4}$ to 2 inches in thickness; and the lower part of the spindle that forms the pivot is from 5 to $6\frac{1}{2}$ inches in diameter.

Formerly upon the barrel in the wake of the partners, were let in and fixed iron ribs, to reduce the friction when the capstan was revolving; but now an iron hoop, in two parts about 4 to 5 inches wide, that tongue into each other, is bolted to the barrel with three bolts in each part.

Barrels to single capstans extend to two decks, or are short and work upon an iron spindle. When they extend to two decks, the upper part is formed to the lower part of the welps, or to $\frac{3}{4}$ of an inch above the partners to ten squares; from an inch above the upper side of the partners, to $\frac{3}{4}$ of the diameter down, they are formed cylindrical; from thence to the lower end conical, with the lower end about $\frac{3}{4}$ the diameter of the barrel at the partners: a hoop five inches broad is driven upon the barrel in the wake of the partners; the upper end has a tenon for the drumhead, and is hooped the same as double capstans, and the lower end has a hoop driven on 4 inches wide, and a collar-headed bolt driven into the end upon a plate which is bolted with four short bolts to form the pivot. Short barrels with iron spindles are formed their whole length to ten squares. They have a hoop on the lower end about three inches wide, and the upper end has a tenon formed about four inches long, and hooped the same as to double capstans. The spindles upon which these capstans revolve have their lower ends formed square, which is fixed in a step, from 12 to 14 inches deep, and from about 16 to 20 inches wide, and passing quite through

it with an iron plate let in fair on the upper and lower side of the step and closely circumscribing the square part of the spindle, the upper one fitting close upon a necking or shoulder formed upon the square part, and both of them bolted with four saucer-headed bolts: there is a bolt likewise that passes athwartships through the step and spindle.

These spindles are seldom made less in diameter than from $3\frac{1}{2}$ to 4 inches, four inches to 150 tons, and increasing one inch for every 100 tons: their upper end, which forms the pivot, is in diameter about $\frac{3}{5}$ of the lower end, which works on an iron plate let into the under side of the drum-head, and has a mortise through it for a fore-lock to pass over the upper end of the barrel, to prevent the capstan rising. The hole through the barrel for the spindle is about $\frac{1}{8}$ of an inch longer than the spindle; and to prevent the friction, an iron plate is let into the upper and lower end of the barrel, closely circumscribing the spindle, about $\frac{3}{4}$ of an inch thick, but they have a ring welded on them about $\frac{3}{4}$ of an inch deep, to make a larger bearing, and are bolted with four saucer-headed bolts.

The welps or whelps are of oak, and are brought upon every other square of the barrel, or every other angle is taken off to form a seating for them; they extend from one inch and $\frac{1}{8}$ to one inch and $\frac{1}{2}$, or what they let into the drumhead, to about $\frac{3}{4}$ or one inch of the partners, or the smallest distance, that when the capstan is revolving, their ends may clear the partners; but when there is a paul head, they extend no lower than to let, from one inch and $\frac{1}{2}$ to one inch and $\frac{3}{4}$, into it. That part of the welp upon which the rope passes up and down to the greatest limit, is called the surge, and the angle this part of the welp makes with a vertical line is called the surging power; this power ought to vary inversely with the number of welps, because the friction decreases with the number; as that part of them, where the turns are taken, approaches nearer to the form of a truncated cone, will cause the angles in the rope by passing round the welps to be be small; but on the contrary, when the number of welps is decreased, the rope will be brought into greater angles, and the friction will be increased. The common angle given to the outline of the welp, from a vertical line, is about $9^{\circ}.30'$ to 10°; this surging power, will be found

to answer very well with five welps, but will be too much for six, when 9° will be sufficient. The friction is not only increased by lessening the number of welps, but it is increased with the strain; and it is frequently found that the messenger or other ropes with three turns and half, with a great strain, is obliged to be slaked, to allow it to rise up the welps, or what is called surge, while with a smaller strain it will require considerable strength to hold on; therefore to regulate the surging power under these circumstances, the outline of the welp up and down is formed to an arc of a circle, and the inclination before given is made the cord of this arc, so that as the messenger or the ropes descend, will be brought upon an increased ascending or surging power.

The length of the surge is in general from 20 to 21 inches, and the lower part is placed, to the welps of the lower capstan, about $6\frac{1}{2}$ inches, and to the upper, and all single capstans, or those without a paul head, about $4\frac{1}{2}$ inches above the lower end; at the upper part of the surge a stop of one inch and $\frac{1}{4}$ is formed, and above it the welp is inclined the same as the surge. The outer part of the stop is from an inch and $\frac{1}{4}$ to an inch and $\frac{1}{2}$ above the surge, so as to incline upwards. The upper end of the welp is in general from 9 to 10 inches above the outer part of the stop, or to let into the drumhead and trundlehead, $1\frac{1}{2}$ inches.

The welps are in breadth, at the inner part, the same as the square, and are broader at the outer part, so as to increase in breadth about $3\frac{1}{4}$ inches in a foot; and in and out at the upper part of the surge, from $3\frac{1}{2}$ to 7 inches.

The welps, when brought upon the squares, are let into the barrel half an inch, and placed with their middle line, in and out, tending to the centre of the barrel, or square to the seating. They are fastened with two bolts in each, one above and one below the surge, and one treenail generally at the middle of the surge; when six welps, the bolts will pass through one and its opposite, and are clenched upon the welps; but when only four, they are clenched upon the barrel.

The chocks are pieces placed between the welps for aiding them, and forming the whole in one mass; there are two in each compartment. The upper one both to the

lower and upper capstan is from 3 to $3\frac{1}{2}$ inches deep, and placed with its lower part about one inch and $\frac{1}{2}$ above the upper part of the surge; the lower one, to the upper capstan, is from $3\frac{1}{2}$ to $4\frac{1}{2}$ inches deep, and has its lower part from one inch to one inch and $\frac{1}{2}$ below the lower part of the surge; and to the lower capstan it is from 6 to $7\frac{3}{4}$ inches deep, and its under side fays on the paul head. The lower chocks have their outer parts formed to an arc of a circle, with radii equal to the distance of their upper and lower edges from the center of the barrel.

The chocks are faced or tailed into the welps about half an inch, and have one short bolt driven through the middle of them, into the barrel.

The drum and trundle heads are pieces formed to circles for fixing the bars in. The drum-head is fixed upon the upper end of the barrel, and is the head of the upper capstan, or the head to all single capstans. They are of elm, and formed of four semi-circular pieces, of a radius equal to half the diameter of the drum-head, so that two of them joined together forms the circle; the two upper pieces are in general one inch thicker than the lower, as the upper part is bearded down one inch from half the diameter. The four pieces are united together, so that their joints may be at right angles to each other, with eight bolts, two about three inches without each side of the mortise, and two inches on each side of the joint, and mostly one between each hole: about three inches in from the circumference, sometimes an iron hoop three inches wide is let in flush at the under side, about an inch and a half in, with one bolt passing through it, between the holes; at other times the outer parts are fastened by square staples let in between the holes. The holes are in number according to the rate of the ship (see BARS); they are square at the outer part from $3\frac{1}{2}$ to $4\frac{3}{4}$ inches, and deep from $10\frac{1}{2}$ to 17 inches, and taper about one inch in a foot; the lower part is taken in horizontal.

The drum-head lets on the barrel (see BARREL and WELPS), and is fastened down with three saucer-headed bolts, which are driven through the upper chock, and forelocked on the under side. The lower side is in general from three feet three inches to three feet four inches above the deck.

The trundle-head is in general about four inches less in diameter than the drum-head, but is put together, bolted, let down upon the welps, and fastened down, in the same manner: it has two less bar holes, and the barrel passes through it.

The paul-head is a circle, and is for fixing the pauls to: it is of elm, and in general formed of two pieces; its lower part is kept well with the lower end of the barrel, and about one inch above the step, and faces upon the welps (see WELPS). Upon the lower and upper sides, two inches from the circumference, there is a hoop about three inches wide let in flush, and bolted with countersunk bolts, to pass through both, about fourteen inches apart, except where the hoop crosses the joint of the two pieces that compose the head, where they are placed three inches on each side the joint. This head is united to the capstan by bolts that pass through it and the lower chock.

The paul rim is a cast iron rim into which the pauls catch, to resist the return, or what is called to paul the capstan. This rim is from 4 to 5 inches broad, and from $3\frac{1}{4}$ to $4\frac{3}{4}$ inches deep, and is bolted to the deck with 12 counter sunk bolts, or one through every stop. The step is taken away, so as to be well with the inner circumference of the ring, and its upper part on a level with the upper part of the rim. The spaces left between the sides of the step and rim on each side are filled up with two pieces of oak plank, with their upper surfaces on a level with the upper surface of the rim and step.

The paul-head and rim is seldom fixed to the foremost capstan, when there is one.

With a paul-head there are four drop pauls, placed at equal distances, and fastened to the head with bolts, upon which they revolve, from 12 to 20 inches in length, and from $1\frac{1}{4}$ to $2\frac{1}{4}$ inches in diameter. Sometimes a hoop is placed upon the head to receive them, but most commonly a plate is let in flush from 6 to 12 inches in length, and from $4\frac{1}{2}$ to 6 inches wide for each. To hold the pauls up when not in use, ketch or slip bolts are fixed in a plate, which is fastened to the head, to slide in and out; the inner ends of these bolts are in general $\frac{1}{4}$ of an inch larger than the outer, that they may be tight in the iron plate when out.

The step is fixed, lying fore and aft, on the lower deck of ships of the line, and upper deck of frigates; it is a solid piece of oak, from 20 to 24 inches broad and from 19 to 22 inches deep, kept above the deck the depth of the paul rim. It is let down between two beams into a score of about an inch and $\frac{3}{4}$ taken out of them half way down, and a face from them to the lower part of the step of about $\frac{3}{4}$ of an inch on; it laps upon the beams to the head-ledge, if the beam forms a hatchway, if not, half way on.

The steps to single capstans, that revolve on an iron spindle, have the scores in the beams taken down, the after one parallel to the side of the beam and the foremost one to strengthen down, that the step may act against the spindle, the strain being in general forward. The steps are bolted with from two to three bolts at each end, which pass through the beam.

The partners lie athwartships, and enclose the barrel between the two capstans; they are composed of several breadths, that fill up the space between the two beams, sometimes called the capstan room, which is always sufficiently large for the capstan to pass up and down. This space or room is framed round with comings and head ledges, the same breadth and heighth above the deck as those to the hatchways. The comings have a rabbet taken out to receive the ends of the partners. The rabbet is not taken directly down, but inclined, as the partners lap over them part of their thickness.

The several breadths of partners are rabbetted together, and the two middle pieces, that circumscribe the barrel, are left as wide as possible, with their joint at the centre of the barrel. Each breadth is bolted with two bolts in each end, that pass through the comings and carling under it.

An iron hoop is placed in the partners round the hole for the barrel, about $4\frac{1}{2}$ inches in breadth, and projecting above the upper part of the partners, about one inch and $\frac{1}{2}$.

Carling (see Timber).

Carling (Swedish, *karflar*; Danish, *kraveller*; Dutch, *grieten*, *karvielen*; German, *balkfüllings;* French, *traversins des baux, ou barrotins;* Italian, *traversi dei bai*;

Spanish, *atraversannor de los baos*; Portuguese, *chassos dos vaos, chassos das cubertas)* between the beams (300).

Fore-and-aft Carlings. These are carlings brought under the beams for particular support. They are placed, one (*p*, fig. 9) below the mizen step, under the gun-deck beams, extending from the beams before the step to the sternson or to the fore side of the transom, and are secured to it by a chock (*q* and *k*, fig. 9) and a plate (*r*); One beneath the galley, under the upper or middle deck beams, extending from the fore beam of the fore hatch to the beam abaft the foremast; and one under the orlop beams between the fore and main hatchways. These carlings score and face one inch and a half on the under side of the beams, and are bolted through them.

Carack (Swedish, *karake*; Dan. *karake*; Dutch, *kraak*, *karak*; German, *karake*; French, *caraque*; Italian, *caraca*; Spanish, *caraca*; Portuguese, *caraca)* a Portuguese Indiaman.

Carrick Bitts (see Bitts).

Carved Work (Swedish, *bildhuggeri*; Danish, *billedhuggerie*; Dutch, *beeldwerk*; German, *bildwerk*; French, *sculpture*; Italian, *scultura*; Spanish, *escultura*; Portuguese, *escultura)* is the ornamental part of the head, stern, and quarters, and when properly applied gives a lightness and elegance to the structure.

Carvel Work (Swedish, *cravel, bygd pă cravel*; Danish, *kravel, bygt paa kravel*; Dutch, *karvielwerk, met karvielwerk opboejen*; German, *karvielwerk, mit karvielwerk aufbugen*; French, *border en carvel à joints quarrés*; Italian, *mettere le tavole delle bande di maniera che i canti si toccano perpendicularmente, ó che fauno un incomento*; Spanish, *tablas unidas con los cantos de manera que hazen una costura or dinaria*; Portuguese, *fiadas de taboas unidas de topo e canto)* when the planks of the bottom are brought edge to edge, and the seams are caulked in and out, as the other planking. It is a term applied principally to cutters or small vessels and boats, to show that they are not clincher built.

Cast, any timber that has a turn or bend to clear any part is said to have a cast; as the cast knees (*b*, fig. 27) which are made to cast in order to clear the ports (203).

Cat Beam, a beam formerly placed with its fore part to receive the stanchions of the beakhead bulkhead, and the after part for securing the inner part of the cathead; it was mostly in two breadths, tabled and bolted together.

Cat Block (see Blocks, *fixed.*)

Catheads (Swedish, *kranbalk*; Danish, *kranbielke*; Dutch, *kraanbalk*; German, *krahn-balken*; French, *bossoir*; Italian, *grua*; Spanish, *serviola*; Portuguese, *turco)* are timbers projecting from the bow of the ship (nearly perpendicular to it horizontally) for hoisting the anchor, after the cable has brought it clear of the water; they have two or three vertical shives at the outer end, and are of sufficient length for the flukes of the anchor to clear the bow when hoisted, and have considerable flight or rise.

The cathead to large ships has the inner end, or what is sometimes called the cat's tail, with a small cast if required, and brought to lap under a forecastle beam, through which it is bolted with two bolts; and to small vessels that have no forecastle, or when the forecastle is not sufficiently firm to receive the inner end, it is made to return down the inside of the bows. It has in general two hoops on the outer end, one without and one within the shives, and is supported on the under side by a knee placed nearly vertical, called the cathead supporter, which is bolted in and out through the bow and up and down through the cathead; when the inner end of the cathead extends down the bow inside, the in and out bolts pass through it. It is supported, sometimes, on the aft side, by an iron knee lying to the sheer.

The part formed in the bow to receive the cathead is called the bed, and is well caulked and leaded.

Caulk (Swedish, *kalfatra, drifva*; Danish, *kalfatre, digte*; Dutch, *kalfaaten*; German, *kalfaten, kalfatern*; French, *calfater*; Italian, *calafatare*; Spanish, *calafatear*; Portuguese, *calafetar).* (See Note 1). In caulking, the thickness of the planking and the parts to be caulked determines the quantity of oakum that is to be driven into each joint. *New weather decks* of two inches in thicknes have one thread of white and one of black

oakum; $2\frac{1}{2}$ and 3 inches, one of white and two of black: *gun decks* of three inches in thicknes, one of white and two of black; and four inches, one of white and three of black: *sides* have, to $2\frac{1}{2}$ inches in thickness, three of black, and to 3-inch, four. *New bottoms, wales,* &c. have sometimes to all thicknesses, two threads of spunyarn, and to 4 inches in thickness five threads of black, to 5-inch six, 6-inch seven, 7-inch nine, 8-inch ten, 9-inch eleven, 10-inch twelve, 11-inch thirteen, and to 12-inch fourteen threads. And that the proper quantity may be got into the joints, they are made close at the inner part, and left open at the outer, about half an inch in ten inches. This is called allowing seam. The progressive manner of performing the caulking is by first caulking the treenails, if any, then by driving wedge-like irons into the seams (except to fir decks) to close the rends or shakes, and open the seams. This operation is called raiming or reeming. After this the spunyarn or white oakum is driven, if any, and then the number of black threads, which are then (except fir deck and some other parts, when the caulking is not of much importance) hardened, or what is called horsed up; this is done by one man holding, in the seam upon the oakum, an iron fixed in a handle, called the horse iron, and another driving upon it with a large mallet, called a beetle, that the oakum may be made as firm as possible, and be within the outer surface of the plank. It is of importance, in order to give firmness by the caulking, and to prevent decay, that the threads, as they are driven into the seam, should be got in as far as possible, or driven home, and not choaked, as is sometimes the case, and mostly by foreign nations; but that the whole of the oakum driven should form as a wedge, as far in as the thickness of the plank, or what is called be well bottomed.

Cieling or Footwaling (Swedish, *vägare;* Danish, *væger;* Dutch, *waager of weeger;* German, *weger, wegering oder weigering;* French, *vaigres;* Italian, *fasciame di dentro, fiube, ferrette, verzene;* Spanish, *carretas, cinglones;* Portuguese, *escoas*). (132).

Cells (see Sills).

Chains, iron links that secure the dead-eyes connected with the channels to the side; the part which cir-

cumscribes the dead-eye is called the binding: the links of the chain are called the upper, middle, and toe links.

CHAIN BOLTS, the bolts that pass through the toe links and secure the chains to the side; they are formed in general with large and strong heads, called T heads (see BOLTS), that the chain and dead-eyes may be taken down without driving them out. The main and fore channels to all vessels above the small class of brigs have a preventer plate to support the chain bolt; this plate has a hole in each end, the upper one for the chain bolt, and the lower one for a bolt called the preventer bolt. The upper hole in the plate is made to the form of the head of the chain bolt, that when the plate is turned to a right angle from its proper position it may be taken off the bolt; and to allow its lower end to be brought over the point of the preventer bolt, which is driven from the inside, and forelocked upon the plate. A thin plate of iron is placed under the head of the chain bolt, upon the upper part of the preventer plate, which has a hole in it to the form of the bolt, that it may be first turned round and then taken off.

CHANNELS (Swedish, *rustar*; Danish, *ryster eller röster*; Dutch, *rusten*; German, *rusten oder rüster*; French, *porte-haubans*; Italian, *parasarchie*; Spanish, *mesas de guarnicion*; Portuguese, *mesas das emxarcias*) an assemblage of planks lying horizontally in and out, and to the sheer longitudinally, and projecting outwards from the side of the ship. They are placed to each mast, with their fore ends as much before the mast as to have one dead-eye rather before the centre, and of sufficient length to receive as many dead eyes as may be necessary. The fore channel has in general the topmast and topgallant back-stay dead-eyes affixed to it; but to the main and mizen channels, there are in general separate stools for them, called the back-stay stools.

The channels are for giving a greater spread to the shrouds, and are of a breadth sufficient for the shrouds to clear the barricading or hammock stantions at least six inches. The fore channel is narrowed at the after end, to allow the spare and sheet anchor to be stowed, that the shank may lie without the shrouds, and for the palm to

come within the chock; to obtain this, their outer edges are curved in. Their fore end extends in general sufficiently before the foremast dead-eye to receive the anchor lining.

The channels are placed commonly with their lower sides about one inch above the lower edge of the upper sheer strakes of ships that have them; except the mizen channel of two deck ships and upwards, which is placed above the quarter-deck ports, about an inch above the first seam: they are in general from 4 to 5 inches in thickness at the inner edge, and from one inch to one inch and a half less on the outer edge.

The planks that compose the channel have their edges coaked together with coaks about 3 feet apart, and the channels are bolted to the side with bolts from 3 to 4 feet apart, except the stools or channels cut off by the ports, when there is never less than two bolts, and supported by two knees, commonly called knee plates, or T plates, between each port, generally on the timber next the port timber, and when the ends of the channels extend beyond the ports far enough, one is placed from 12 to 18 inches from the ends. These knee plates have their upper ends let through the channel and have an arm under the channel extending sufficiently within the arm that is connected to the side, to have two or three up and down bolts, and out, to receive one up and down bolt: the up and down arm that forms a prop or tie from the side to the channel is bolted to the side with one collar-headed bolt. The up and down bolts, which are eye bolts or saucer headed, pass through a plate that is let into the upper part of the channel directly over the channel arm of the knee, and the upper end of the knee that projects above the channel has a hole for a span shackle.

The dead eyes are placed for the chains to clear the the ports below the channel, and the ports above are placed to clear the shrouds. The binding of the dead eyes is let in to be well with the outer part of the channel, and a rail is brought over them, called the channel rail; this rail is as deep as the channel is thick at the outer part, and in breadth an half inch less than its depth: it is fastened in

general with saucer headed bolts driven between the dead-eyes about twice the breadth of the rail into the channel, and sometimes strops are placed over the rail, that in the event of the masts being carried away, the rail may keep the dead eyes up to clear the shrouds with greater ease.

Cheek Blocks, blocks in general brought upon the side of bitts for fair leaders.

Cheek Blocks (see Topmast) (401).

Cheeks of the Mast (Swedish, *kinnbackar pă masten*; Danish, *kindbakker paa masten*; Dutch, *klampen of kinbakken aan de masten*; German, *backen der masten*; French, *jottereaux ou flasques des mâts*; Italian, *gaetelle o maschetti degli alberi*; Spanish, *cacholas*; Portuguese, *romaom do mastro*). (339).

Cheeks of the Head (Swedish, *slöy knăn*; Danish, *slöy-knæer*; Dutch, *sloi-knies*; German, *backen-knien, schloi-knien oder schliess-knien des galjons*; French, *courbes de jotteraux*; Italian, *bracciuoli di polena*; Spanish, *curvas bandas*; Portuguese, *curvas do beque*). (Note 7, see Head).

Chesstree (Swedish, *halsklampar*; Danish, *halsklamper*; Dutch, *halsklampen*; German, *halshölzer, halsklampen*; French, *dogues d'amure*; Italian, *castagnuole della mura*; Span. *castannuelas de la amura*; Portuguese, *castanhas ou gornes das amuras)* pieces formerly bolted to the side, outside, at a proper distance before the main mast (see Fixed Blocks) for hauling home the main tack.

Chocks (Swedish, *klăssar;* Danish, *klosser der sættes imellem;* Dutch, *klossen, kalven;* German, *kalben, kalven;* French, *entremises, clefs;* Italian, *incimenti;* Spanish, *entremiches;* Portuguese, *chassos)* pieces brought on different timbers to fashion them out.

Chocks at the Heads and Heels of Timbers (71).

Cross Chock (71).

Bowsprit Chock (see Bowsprit).

Chine, the part of the waterway (239) left above the deck, and hollowed out to the spirketting.

Chince or Chinse (see Note 61).

Cistern (Swedish, *pumpback;* Danish, *pompebak;* Dutch, *pompbak;* German, *pumpenback;* French,

cisterne; Italian, *cisterna;* Spanish, *caja alta;* Portuguese, *cisterna)* a vessel for holding water, placed in different parts of the ship; as the cistern in the well for washing decks, to chain pumps, &c. (see Pumps).

Clamps for the Beams (Swedish, *balkvägare;* Danish, *bielkevægare;* Dutch, *balkwaager;* German, *balkwäger oder balkweger;* French, *bauquière;* Italian, *dormente;* Spanish, *durmente o' durmiente;* Portuguese, *dormente).* (142).

Clean. When the ship is sharp or the body acute, she is said to be clean; as a clean run, she is clean forward, or aft.

Cleats or Kevels (Swedish, *klampar, krampar;* Danish, *klamper;* Dutch, *klampen;* German, *klampen;* French, *taquets;* Italian, *tacchj;* Spanish, *tojinos;* Portuguese, *cunhos)* a frame consisting of four pieces bolted to the side inside, one lying in the direction of the strakes, and two curved pieces let through it, with kevel heads, for belaying principal ropes to; mostly used in foreign ships.

Belaying Cleats (Swedish, *horn-krampar;* Danish, *kryds-klamper, horn-klamper;* Dutch, *kruis-klampen;* German, *horn-klampen oder kreuz-klampen;* French, *taquets à cornes ou à branches;* Italian, *castagnuole;* Spanish, *manignetas;* Portuguese, *cunhos da mariacaom)* cleats fastened to the side of the ship and to the shrouds, for making fast different ropes. Those for belaying the tacks and sheets are in general called ranges, and are bolted to the side with two bolts, driven considerably within the outer part of the range, to prevent the ropes from catching or being injured.

Cleats or Brackets under the Cross-piece to the Riding Bitts (Swedish, *betings-klampar;* Danish, *bedings-klamper;* Dutch, *klampen onder beetingbalk;* German, *betings-klampen;* French, *taquets des bittes;* Italian, *tacchj della traversa delle bitte;* Spanish, *tojinos de la cruceta de la bita;* Portuguese, *cunhos da travessaom da abita)* for supporting them (see Bitts.)

Yard-arm Cleats (Swedish, *näck-klampar*; Danish, *nok-klamper*; Dutch, *nok-klampen*; German, *nock-klampen*; French, *taquets de bout de vergue ou de pointure de ris*; Italian, *conj dei pennoni*; Spanish *tojinos del*

penol; Portuguese, *cunhos do laiz)* cleats fastened on the yards (see 424, 430, 434, 436, 438, 440; and NOTES 74 and 75).

Gammoning Cleats (Swedish, *vulings-klampar*; Danish, *voulings-klamper*; Dutch, *klampen aan de boeg-spriet-woeling*; German, *bugspriet-wuhlings-klampen*; French, *taquets de lieures de beaupré*; Italian, *tacchj delle trinche del copresso*; Spanish, *tacos de las trincas del baupres*; Portuguese, *cunhos das trincas do gorupes)* cleats brought on the bowsprit for preserving the gammoning in its position.

CLINCH OR CLENCH, TO CLINCH (Swedish, *klinka*; Danish, *klinke*; Dutch, *klinken*; German, *klinken oder verklinken*; French, *river*, *claveter une cheville sur virole*; Italian, *ribadire*, *ribattere*; Spanish, *rebater los pernos*; Portuguese, *aninar)* to spread the point, or rivet it upon a ring, to prevent the bolt from drawing (see BOLTS).

CLINCH WORK (Swedish, *bygde pă klink*; Danish, *klinke bygning*; Dutch, *zoomwerk*; German, *ein klinkerweise gebauetes fahrzeug*, *klinkerwerk*; French, *bâtiment bordé à clin*; Italian, *le tavole delle bande l'una sopra l'altra*; Spanish, *barco tinglado*; Portuguese, *barca que tem os costados com tablas)* is when the strakes of the bottom have their lower edges lapping or overlaying the upper, on the outside; and the fastenings passing through the two planks where they lap, between the timbers, from the outside, and turning or rivetting on the inside: where the timbers come, the fastening passes through, and turns or rivets upon them. Vessels that have the plank of the bottom worked in this manner, are said to be clincher-built (see CARVEL WORK).

COAKING (Swedish, *damning*; Danish, *tilsammenföyelse af masternes vangerne*; Dutch, *schaakwerk*; German, *schakwerk*; French, *callebotes*; Italian, *indentamento delle gallapazze nell'albero*; Spanish, *adentamiento de los chapuces al alma del palo*; Portuguese, *adentamento das chumeas a alma do mastro)* sometimes called dowelling, the placing pieces of hard wood, either circular or square, in the edges or surfaces of any pieces that are to be united together, to prevent their working or sliding over each other. Circular coaking has been introduced instead of

tabling, which was by forming one piece into another by alternate projections on each side of the middle, to prevent their working lengthways, or from side to side, as in putting together made beams, channels, knee of the head, rudder, &c. The circular coaking is performed by placing the surfaces that are to be united together in their proper position, and boring holes through one piece into the other, with a small auger, at the center of the station of every coak, which will give the center agreeing at the two surfaces; then with a circular engine called a dowel engine, which has a spindle connected to it at the center, corresponding to the size of the auger, circular holes are bored into each piece, an inch and a half generally, which will correspond at their circumferences, consequent upon their centers agreeing, and their being formed by the same engine: pieces of circular wood, three inches long, frequently of lignum vitæ, or some hard wood, formed from a corresponding engine, are then driven into the holes of one of the pieces to be united, and the pieces brought together. Sometimes the circular coaks are made of hollow cylinders of cast iron, filled in with a cement.

Comings (Swedish, *luck-ramarna*; Danish, *luge, karmer*; Dutch, *hoofden, koppen*; German, *scheerstocken der luken*; French, *vassolles, chambranles*; Italian, *mascellaj, mezzanili dei boccaporti*; Spanish, *brazolas*; Portuguese, *bracolas)* framings round the hatchways, ladderways, and scuttles, to prevent the water of the deck from flowing down; they are therefore of greater height to those decks that are the most subject to the encroachment of the sea. The comings are the pieces that lie fore and aft on each side of the hatchways, &c. There is a carling let down between the beams immediately under them (301) into which they have two or three circular coaks and are fastened to them with two or three treenails: a rabbet is taken out of their upper edge; when for gratings or hatches, from the inner edge, but when for cap scuttles, or companions, from the outer, when they are of a parallel thickness. To the main and after hatchways a rabbet is likewise taken out from their lower inner edge to allow the gratings to be placed on a level with the deck when they are working the pumps; and to all working hatchways an iron plate is

let in flush on their upper and inner side with the edges of the plates well with the rabbet. The pieces that lie athwart and form the framing at the fore and after part of the hatchways and ladderways, are called head-ledges; these pieces lap and tail over the comings and are faced into their sides about ½ an inch, and are bolted with one bolt at each end, that passes through them, the comings and beams, &c. and one or two besides, that pass through the beam; if one, it is placed at the middle line, and if two, at equal distances on each side of the middle. When the hatchways are covered by gratings, the head-ledges have their upper parts formed to a round, but when for cap scuttles or companions, they are in general straight.

Companion (Swedish, *kappa eller rufföfver aktertrappan*; Danish, *stirresen, ruffet over agter-trappen*; Dutch, *kap*; German, *kappe der luken*; French, *capot d'échelle*; Italian, *capello della scala*; Spanish, *sombrero de la escalera*; Portuguese, *meia laranja)* the hood or covering in flush-deck vessels over the ladder way to the captain's cabin, also the framing, formed with glass, at the upper parts or sides, over the captain's cabin, ward or mess rooms, or other officers' apartments, for keeping out the weather, and giving light.

Coping, to turn the ends of iron knees, to form a hook in the beams, &c.

Corvet (Swedish, *corvette, beväpnat fartyg*; Dan. *korvette, et slags-fartöy*; Dutch, *korvette*; German, *korvette*; French, *corvette*; Italian, *corvetta*; Spanish, *corveta*; Portuguese, *corveta)* a flush-deck vessel ship-rigged, or a ship with one entire battery, without a quarter-deck and forecastle, except that it mostly has what is called by seamen a top-gallant forecastle, for the shelter of the crew.

Counter. *The Lower Counter* (Swedish, *hvalfvet*; Danish, *den underste gilling*; Dutch, *wulf*; Germ. *die gilling des schiffs oder die hintergilling, grasse gilling*; French, *voute ou grande voute*; Italian, *fornello, forno da poppa, carreca*; Spanish, *babeda ó bobedilla*; Portuguese, *almeida)* is that part of the ship right aft, or the stern immediately above the wing transom; it is formed by a curve, arched upwards from the upper and aft side of the wing transom to the first or lower counter rail (80).

The Upper Counter (Swedish, *öfra hvalfer*; Dan. *överste gilling*; Dutch, *knik-wulf*; German, *die kleine gilling des schiffs über der grossen*; French, *contre-voute*; Italian, *contra carreca, seconda carreca*; Spanish, *segonda bobeda, contra-bobeda*; Portuguese, *contra-almeida)* sometimes called the second counter, is immediately over the lower counter, or between the lower counter and lights; the upper part is formed by the upper counter-rail, and lower part by the lower counter-rail. The plank of the lower counter is in general the same thickness as the plank of the bottom, and fastened to the counter timber by treenails or nails; sometimes each strake has one treenail and one nail in every timber. The upper counter is in general from 2½ to 3 inches in thickness, and if in more than one breadth of plank, they rabbet together. This counter rabbets into the rails.

*Counter Timbers (*Swedish, *hvalfvets knăna*; Dan. *gilling knæer*; Dutch, *wulf-knies*; German, *gillinghölzer oder gillingknien*; French, *courbes de voute*; Italian, *carreche*; Spanish, *gambotes*; Portuguese, *cambotas)* (79).

Cove (Swedish, *hvalfvet öfver altanen*; Danish, *gillengen boven galleriet*; Dutch, *plantsier*; German, *plantsier*; French, *voûte de la galerie*; Italian, *volta sopra la gallerie*; Spanish, *bobedilla del corredor*; Portuguese, *almeida do jardim)* an arch formed immediately over the upper lights of the stern, springing, formerly, from a bracket or truss, in general called terms or term pieces, brought on the side counter timber, or upon the munion that covers it; but now it springs from the outside of the outer lights, and terminates on a plain moulding. The upper and lower part of the cove is formed by moulding, mostly astragals; the lower one is called the necking.

Crab (Swedish, *lös spel, krypple-spel*; Danish, *kröbbel-spil*; Dutch, *los spil, kreupel-spil*; German, *loses spill, loses gang-spill*; French, *cabestan volant*; Italian, *argano volante, (b) piccolo mulinello di ferro*; Spanish, *cabrestante volante*; Portuguese, *cabrestante volante)* a small capstan fixed in a frame, and made portable, that it may be used for different purposes; likewise a wooding spindle, with its lower end working in a socket and

circumscribed at a convenient distance from the upper part by pieces similar to the partners of a capstan; and having at a proper height from the lower end, two holes, at right angles to each other, which pass quite through the spindle, for receiving the bars. This machine, which is simple in its construction, and has great mechanical power, on account of the length of the bars and smallness of the spindle, is used principally while the ship is building; and a similar one on board of ships in ordinary for hoisting their water, &c. on board.

CRADLE (Swedish, *aflöpnings-slade*; Danish; *slæde*; Dutch, *slede*; German, *schlitten worauf ein schiff abläuft*; French, *berceau*; Italian, *l'invasare*; Spanish, *cuna*; Portuguese, *berco*) a strong frame made under the bottom of the ship for supporting her when launching (see LAUNCH).

CRANKS, iron rods bent at each end, and generally attached to the beams, at different parts of the ship, for stowing capstan bars, spunge rods, &c.: likewise the iron frame that supports the poop lanthorns.

CROAKY. When plank or timber forms sudden and inflected curves it is said to be croaky.

CROSS CHOCKS (see CHOCKS).

CROSS-JACK YARD (see YARDS).

CROSS-PIECE TO BITTS (see BITTS).

CROSS-SPALLS, pieces of fir plank that keep the frame of the ship to its proper breadth until the beams are in, when they are removed (72).

CROSSTREES (Swedish, *tvärsalningar*; Danish, *tvær-salinger*; Dutch, *dwars-zaalingen*; German, *dwars sahlingen*; French, *barres traversières de hune et de perroquet*; Italian, *crocette*; Spanish, *crucetas*; Portuguese, *curvatois*) (342).

Topmast Crosstrees (Swedish, *salningar*; Danish, *salingar*; Dutch, *zaalingen*; German, *sahlingen*; French, *brarres de hune*; Italian, *crocette*; Spanish, *crucetas*; Portuguese, *vaos e curvatoes*) (403 to 406).

CRUTCHES (Swedish, *resande botnstockar*; Danish, *pigsuer*; Dutch, *sogstukken*; German, *piekhölzer, piekstücke*; French, *fourcats*; Italian, *forcazzi*; Spanish, *piques*; Portuguese, *enchimentos*) timbers aft lying square

to the body, and extending equally on each side of the keelson, for uniting the two sides abaft the floors. The crutches are now formed of two pieces, and an iron brace (fig. 34) to save the crooked timber; and when with a diagonal frame, the ends of the timbers extend down, and meet at the middle line, where they are combined by an iron brace.

CUTTER (Swedish, *kutter*; Danish, *kutter*; Dutch, *kutter*; German, *kutter*; French, *cutter*; Italian, *balandra*, *cutter*; Spanish, *balandra*, *cutter*; Portug. *chalupa*, *cutter)* a small vessel, vessel-rigged as a sloop; they are frequently distinguished in his Majesty's service by king's cutters and revenue cruizers; the former is employed against a foreign enemy, to carry dispatches, &c. while the latter is employed against an illicit trade.

Cutter (see BOATS).

CUT-WATER (Swedish, *skiägg*; Danish, *skiœgget*; Dutch, *schagt*, *schegge*; German, *schaft oder scheg des schiffs*; French, *taille mer*, *la guibre*; Italian, *tagliamare*; Spanish, *tajamar*; Portuguese, *talha mar)* a name given by seamen to the knee of the head (see HEAD).

DAGGER, a term given to all timbers lying diagonally, as dagger-knees (203), &c.

PUMP-DALE (Swedish, *pump-ränna*, *dala*; Danish, *pomperende*, *pompe-dœle eller pompedale*; Dutch, *daal van de pompe*; German, *daal*, *pumpendaal*; French, *dale de pompe*; Italian, *dala*; Spanish, *adala ó dala*; Portuguese, *dala*) a conductor for conveying the water from the cisterns to the pumps overboard, when the ship is pumped out. It fixes in a groove at the cistern, and in a cleat at the side. The hole through the side is called the pump-dale scupper; it is formed of lead, and has an iron flap or valve outside, to prevent the sea entering the ship.

DAVIT (Swedish, *penterbalk*, *dävert*; Danish, *dœvis*, *bielke*; Dutch, *penterbalk*; German, *penter-balken*; French, *davit ou minot pour les ancres*; Italian, *pescante per traversare l'ancora*; Spanish, *pescante*; Portuguese, *pao de ferviola*) a beam used, similar to a crane, for what is called fishing the anchor, or bringing up the flukes, after it is brought up to the cathead, or catted, so as to clear the side. It mostly steps on the fore channel in cleats

fixed there for the purpose. These davits are from 9 to 17 feet 6 inches in length, according to the class of ship, and from $8\frac{1}{2}$ inches to $15\frac{1}{2}$ inches square at the lower end, and from $1\frac{1}{2}$ to 2 inches less at the upper end. They are left square from the lower end $2\frac{1}{2}$ diameters, above which they are eight-squared; one diameter up from the lower end they are snaped, and have a necking at the upper end one diameter down.

Boats' Davits, outriggers fixed right aft on each side, at the upper part of the stern, for hoisting the stern boat; and sometimes on each side, opposite the mizen channel, for hoisting the quarter boats; those right aft project beyond the stern rather more than the half-breadth of the boat; they extend along the side forward, and are bolted with from three to four bolts. At the outer end are placed two shive holes for the boat falls, and one hoop for strengthening it; and on the under side is driven one eye-bolt for lashing the boats when up. The quarter davits are fixed to the side between two iron plates, which have a collar-headed bolt to pass through them and the davit, and to forelock, upon which it turns to bring the boats more into the ship when hoisted. Their outer ends have a necking for the pendants, two shives for the falls, and four eye-bolts, one on each square, for the guys, and for lashing the boats, or bringing the stopper to; and frequently a hoop just without the shives. Sometimes a hoop is likewise driven on the inner end for the bolt to pass through.

Dead Doors; these doors are used when the quarter galleries are carried away, to prevent the encroachment of the sea through the gallery doors; they are in general made of deal of an inch and $\frac{1}{4}$ in thickness, called whole deal, and lined with deal of about five-eighths of an inch in thickness, called slit deal, and fixed in a rabbet taken out on the outside of the gallery doors; to keep them in their places they have sliding bolts on the inside.

Dead Eyes (Sweedish, *jungfru*; Danish, *jomfru*; Dutch, *juffer*; Germ. *jungfer*; Fr. *cap-de-mouton*; Ital. *bigotta*; Spanish, *bigota*; Portuguese, *bigota*) pieces of elm of an oblate form, for receiving the laniard for setting up the shrouds through; those attached to the ship are fixed to the outer edges of the channels (see Chains,

Swedish, *puttinger*; Danish, *puttinger, patenter, pytting-kætinger*; German, *puttingen oder pyttingen*; French, *chaines de haubans*; Italian, *lande*; Spanish, *cadenas de las bigotas*; Portuguese, *cadèas da abotucadura*): they have three holes through each, the two upper are perpendicular to the center of the chain about the centre up, and the lower one is placed so as to form nearly an equilateral triangle; they are placed so as for the chains to clear the upper deck ports; but the quarter deck and forecastle are placed to clear them. The foremost is placed in general nearly opposite the center of the mast, and it is desirable that there should be, for giving the best support to them, two or three at equal distances abaft it, before the distance is increased by the ports intervening.

Dead Lights (Swedish, *blind luker*; Danish, *blind luger, lendse-skoder eller lemmer for kahyts vinduerne*; Dutch, *blinden*; German, *blinden oder blindeluken vor den fenstern der kajute*; French, *faux sabords ou faux mantelets pour les fenêtres de la poupe*; Italian, *contra portelli o finestre oscure*; Portuguese, *pastigos de pao*) shutters made as the dead doors, and fixed outside of the stern lights, in tempestuous weather, to prevent the encroachment of the sea through the windows.

Dead-Wood (Swedish, *kläffar*; Danish, *det döde træe*; Dutch, *kielklosten*; German, *kielklotze*; French, *massif*; Italian, *legno che forma il fondo del taglio della nave*; Spanish, *dormidos*; Portuguese, *coral*) a range of timber placed on the upper part of the keel (52 to 59).

Dead Works (Swedish, *öfver skepp*; Danish, *over, skibet*; Dutch, *dood werk huising boven-schip*; German, *ober-schiff, oberwerk ober todte werk*; French, *œuvre morte*; Italian, *opera morta*; Spanish, *obra muerta*; Portuguese, *obra morta*) the upper or supernatant part of the body (1).

Deal (Swedish, *bräde*; Danish, *dæle*; Dutch, *deel*; German, *diehle*; French, *bordage mince*; Italian, *tavola di poco grossezza*; Spanish, *tabla poco gruessa*; Portuguese, *taboinha*) fir similar to planks (see Timber).

Deck (Swedish, *dack*; Danish, *dæk*; Dutch, *dek*; German, *deck*; French, *pont (in der cavante couverte)*; Italian, *coperta*; Spanish, *cubierta*; Portuguese, *cuberta*)

the different platforms in ships for supporting the artillery, for the accommodation of the officers and crew, and for placing the stores. They are distinguished by different names according to their situation and purpose (7).

Upper Deck (Swedish, *öfra däck;* Danish, *överste dæk;* Dutch, *het bovenste dek, het boevenet;* German, *das dritte deck;* French, *troisième pont;* Italian, *terza coperta;* Spanish, *tercera cubierta;* Portuguese, *terceira cuberta*) (7).

Gun Deck (Swedish, *underdäck;* Danish, *förste eller underste dæk;* Dutch, *het onderste dek;* German, *das erste oder unterste deck;* French, *premier pont;* Italian, *prima coperta;* Spanish, *primera cubierta, cubierta principal, cubierta de la bordega;* Portuguese, *primeira cuberta*) (6 and 7).

Middle Deck (Swedish, *mellan däck pă tredäckare eller öfra pă tvädäckare;* Danish, *mellemste dæk paa en tredækker;* Dutch, *het tweede dek;* German, *das zweyte deck;* French, *second pont;* Italian, *seconda coperta;* Spanish, *segonda cubierta;* Portuguese, *segunda cuberta*) (7).

Quarter Deck (Swedish, *halfdäck;* Danish, *half dækket, skandsen;* Dutch, *half dek;* German, *halb deck;* French, *demi-pont;* Italian, *cassaro;* Spanish, *alcazar;* Portuguese, *tolda*) (7).

Forecastle (Swedish, *back*; Danish, *bak*; Dutch, *bak*; German, *back*; French, *chateau d'avant*; Italian, *castello*; Spanish, *castillo*; Port. *castello de proa*) (7).

Poop or *Round-house* (Swedish, *hyttan*; Danish, *hytten*; Dutch, *hutte*; German, *hütte*; French, *dunette, poupe*; Italian, *casseretto da poppa*; Spanish, *toldilla*; Portuguese, *tombadilho*) (7).

Orlop (Swedish, *trässbotten*; Danish, *banierne*; Dutch, *koebrug*; German, *kuhbrücke unten im schiff*; Fr. *faux pont*; Italian, *falso ponte*; Spanish, *sallado*; Portuguese, *baileos do poraom*) (7).

Flush Deck (Swedish, *glatt däck*; Danish, *glat dæk*; Dutch, *glad dek*; German, *ein glattes deck*; French, *pont entier*; Italian, *coperta intera*; Spanish, *cubierta de punta al oreja*; Portuguese, *cuberta corrida*) is when it extends the whole length of the ship without drops or intervals. Cutters, brigs, and corvettes are said to be flush-

deck vessels, by their not having the regular quarter deck and forecastle as to frigates &c.

Deck Planks (Swedish, *däckplanker;* Danish, *dœkplanker;* Dutch, *dekplanken;* German, *deckplanken;* French, *bordages des ponts;* Italian, *tavole di coperta;* Spanish, *tablas de las cubiertas;* Portuguese, *assoalhado das cubertas*) the flooring or covering of the beams (309).

Two-deck Ship (Swedish, *tvädäckare;* Danish, *en todœkker;* Dutch, *tweedecker;* German, *ein zwey-decker;* French, *vaisseau à deux ponts;* Italian, *nave di due ponti;* Spanish, *navio de dos puentes;* Port. *navio de duas cubertas)* ships of war having two entire batteries.

Three-deck Ship (Swedish, *tredäckare;* Danish, *tredœkker;* Dutch, *driedekker;* German, *ein drey-decker;* French, *vaisseau à trois ponts;* Italian, *nave di tree ponti;* Spanish, *navio de tres puentes;* Portuguese, *navio de tres cubertas)* ships of war having three entire batteries.

Deck Transom (Swedish, *däckvarporna;* Danish, *dœkwarperne;* Dutch, *dekworpen;* German, *deckworpen, deckwrangen;* Fr. *barres d'arcasse, barre du premier et du second pont;* Ital. *gue;* Span. *yugos de las cubertas;* Port. *gios*) a timber or beam extending across the ship for supporting the after extremity of the decks, having both the round aft of the stern and round up of the beams. They score and face upon the counter timbers, and are bolted through them with one or two bolts; each end of this transom has an iron knee called the transom knee affixed to it, with one arm extending a certain distance along their fore side, and the other against the side of the ship; if a shelf (229) the side arm is brought down and extends along the front; if not, this arm is brought in front of the clamp (142).

Deck Transom. When the ship has a stern frame, one of the transoms in this frame is made to support the after ends of the lower or gun deck (41).

Depth of Hold (Swedish, *djup i rummet;* Dan. *lastens dybhed;* Dutch, *holte van het ruim;* German, *hohl oder holl des raums;* French, *creux de calle;* Italian, *pontale della stiva;* Spanish, *puntal con que se debe arquear*; Portuguese, *pontal do poraom)* one of the principal dimensions of a ship; it is the depth in midships from the upper side of the upper deck beams, in flush-deck

vessels, and lower deck beams in all others, to the upper part of the limber strake.

Dock (Swedish, *däcka*; Danish, *dokke*; Dutch, *dok*; German, *docke, schiffs-docke*; French, *bassin de construction*; Italian, *baccino*; Spanish, *dique bisc, bacin*; Portuguese, *dique)* a basin for repairing ships, fitted with flood-gates, to prevent the flux of the tide from having a passage into them.

*To Dock the Ship (*Swedish, *at docka*; Danish, *at dokke*; Dutch, *ein schip dokken, of in een dok brengen*; German, *docken ein schiff docken*; French, *mettre un vaisseau dans un bassin*; Italian, *mettere una nave in un bacino*; Spanish, *meter un navio en un bacin ó dique*; Portuguese, *meter hum navio em hum dique).*

Wet Dock (Swedish, *den innersta delen af en hamn*; Danish, *det inderste af en söe-havn*; Dutch, *kom*; German, *docke*; French, *darsine, darse, bassin*; Italian, *darsena*; Spanish, *darsena*; Portuguese, *darsena)* a basin for containing ships afloat.

Dowsing Chock, a chock that crosses the apron and laps on the inside plank, for receiving the messenger rolls when there are no hooks to receive them.

Draught (Swedish, *ritning, tekning*; Danish, *tegning, plan*; Dutch, *plan, tekening*; German, *riss oder abriss eines schiffs*; French, *plan d'un vaisseau*; Italian, *disegno*; Spanish, *proyeccion*; Portuguese, *plano)* designs given on paper for the several parts of the ship; they consist of the *Sheer Draught* (Swedish, *sido-ritning*; Danish, *side-tegning*; Dutch, *zyde tekening*; German, *seiten-riss eines schiffs*; French, *plan d'élévation*; Italian, *disegno d'élévazione*; Spanish, *proyeccion longitudinal*; Portuguese, *plano da elevaçaom*) which has the *Half-breadth Plan* (Swedish, *vattenpass eller horisontel ritning*; Danish, *vaterpasse tegning*; Dutch, *waterpasse tekening*; German, *wasserpasser riss senten-riss*; French, *plan horizontal*; Italian, *disegno orizontale*; Spanish, *proyeccion horizontal*; Portuguese, *plano horizontal*) and *Body Plan* (Swedish, *spant-ritning*; Danish, *spant-tegning*; Dutch, *spant-tekening*; German, *span-riss*; French, *plan vertical, plan de projection*; Italian, *disegno verticale*; Span. *proyeccion transversal*; Portuguese, *plano vertical*) connected with it, profile, and plans of the decks.

The sheer draught gives the vertical longitudinal form, and has delineated upon it all the out-board works, projected upon a plane, passing through the middle line of the keel, stem, and post; as the elevation of the head, and quarters; place and sheer of wales; place of the channels, dead eyes, &c; and place of the ports, drifts, &c. From this plan lines are transferred to the half breadth plan as to length, and to the body as to height. The body plan is that in which the form of the ship is shewn by transverse sections, perpendicular to the keel, which are transferable to the half breadth plan as to breadth, and to the sheer plan as to height. The half breadth plan is that in which is shewn the form of the body by horizontal and diagonal longitudinal sections. The profile is a draught upon which is delineated upon a plane of elevation the whole of the in-board works; it shews the vertical longitudinal section of the ship the same as the sheer draught, and has upon it the height and sheer of decks and ports. The plans of the decks shew the disposition of the in-board works upon the surface of the decks, with their distance from the middle line.

Draught of Water (Swedish, *et skeppes djupgăende*; Danish, *so mange fod vand et skib stikker dybt*; Dutch, *waterdragt*; German, *wassertracht eines schiffs*; French, *tirant d'eau*; Italian, *il pescare della navio*; Spanish, *lo que cala el navio*; Portuguese, *o tirante de agua*) the depth that the body is immersed. Where the surface of the water cuts the body, when the hull is entirely clear, is called the light water line; and the draught of water to this line the light draught of water; and when every thing is on board, the load water line; and the draught of water, the load draught of water. The depth that the ship swims is shewn by marks placed on the stem and stern post, the lower part of the mark shews the feet and the upper part six inches.

Drifts (Swedish, *fortynning*; Danish, *fortönningen*; Dutch, *vertuinning*; German, *zerbrochenergang*; French, *rabattues*; Italian, *risalto del cassaro*; Spanish, *medias hiladas de los castillos*; Portuguese, *alcacha*) (108 to 111).

Drift Pieces, pieces that form scrolls at the drifts (120).

Driver Boom (see Boom).

Drops, carved ornaments, festoons of foilage, or flowers entwined by ribbands, &c. placed on the munions between the lights to the stern and quarters.

Drumhead (see Capstan).

Druxey (Swedish, *fyr i tra*; Danish, *fyr i træ*; Dutch, *vuur in't hout*; German, *das holz hat das feuer*; French, *le bois est cani*; Italian, *legno marcito*; Spanish, *madera que ya está podrida ó blanca*; Portuguese, *madeira apodrecida*) a decay in timber, which has a dark appearance, with white spungey veins.

Dumb Pintle, when the pintle is short and works in a socket brace.

Dunnage Battens, strips of fir or oak nailed across the cable tier, sail rooms, and magazines, to prevent the cables, sails, and powder from being damaged, by admitting air under them. Dunnage battens are likewise placed behind the lining of the bread room, sail room, magazine, &c. to keep the lining from the side. Dunnage likewise signifies, generally, battens or other light pieces used in different stowages to keep the tiers clear of each other.

Ekeings, pieces brought on to make good the length of any principal timbers, or abutting against their ends, as to the cheeks, knees, and the deck hooks. Ekeings are now brought over the stemson, and extend from the middle line to the first beam, and the deck hook is placed upon them, to prevent the consumption of large timber. The hook is coaked to the aft side of them, the quafe on the upper part, so as to cross their abutments at the middle, and the shelf to the lower part, so as to extend four or five feet beyond their after end.

Elm (Swedish, *alm*; Danish, *alm*; Dutch, *olmen, ypen-hout*; German, *ulmen oder ipern holz*; French, *bois d'ormeau*; Italian, *olmo*; Spanish, *olmo*; Portug. *olmo*) a timber used but for few purposes in ship building; principally for the keel (15), on account of its toughness, through which it is not so liable to be injured when the ship takes the ground; nor split by the number of bolts that pass through it, in the same range of fibre, and lower strakes of the bottom (see Note 4).

Ensign Staff (Swedish, *flagstaken;* Danish, *flagstangen*; Dutch, *vlag-stok, vlag-staf*; German, *flaggstab*

oder flaggenstock; French, *baton de pavillon, mât de pavillon*; Italian, *asta della bandiera*; Spanish, *asta de bandera*; Portuguese, *asta da bandeira, paó da bandeira*) the staff placed upon the taffrail, for displaying the ensign; it is secured generally by a step at the lower end, and strap at the upper part of the taffrail or fiferail.

Even Keel, when the ship has the same draught of water before as abaft.

Eye-Bolt (see Bolts).

Face-Piece (see Bitts).

Facing, the letting of one piece into the other, as the facing taken out of the side of the post (42) for the transom (see *k*, fig. 8).

Falling Home, sometimes called tumbling home, what the top side falls in from a vertical line, from the main breadth.

False Keel, (Swedish, *löskö l, străköl*; Danish, *straae kjöl*; Dutch, *loose kiel*; German, *loser kiel, falscher kiel*; French, *fausse quille*; Italian, *sapata della colomba*; Spanish, *zapata de la quilla*; Port. *sobresano inferior ou exterior)* is a keel brought on the under side of the main keel, to preserve it. This keel is fastened to the main keel with short bolts or nails, about four feet apart, on alternate edges, and staples driven into the side, and let in flush, called keel staples, about 2 feet 4 inches apart. The false keel is from 2 to 6 inches in thickness, and but slightly fastened, that in the event of the ship taking the ground it may readily clear itself, and help to free the ship. When the false keel is wanted for making the ship hold a good wind, there are frequently more than one, to increase the lateral resistance. The main keel is coppered on the under side, and between the false keels, if more than one; and on the under side of the lower false keel, where a groove or channel is taken out for the butts and edges of the sheets of copper, that should the ship touch the ground lightly, they may not be rubbed off so easily. The under side of the false keel forward has thick lead brought under it, as far aft as there is danger of the cables rubbing.

False Post (Swedish, *följare utan pa akterstäfven*; Danish, *bagkanten af agterstævnen*; Dutch, *buiten-steven, loose agter-steven*; German, *loser hintersteven, buten-steven*; French, *contre-étambot extérieur*;

Italian, *contraasta esteriore di poppa*; Spanish, *contracodaste exterior*; Portuguese, *contracadaste exterior)* a piece brought on the aft side, at the lower part, of the stern-post, to make good any deficiency of wood, or to allow a smaller piece of timber to do; and should the ship tail the ground, it may defend the main post. This piece is either tabled or coaked to the main post; tabling is most to be recommended, as the edges between the false and main posts are caulked. The coaks in the tablings are about 20 inches in length, and brought with their edges from about $2\frac{1}{2}$ to $3\frac{1}{2}$ inches from the edge of the post; the upper and lower ones are brought on the middle line, and about 10 inches in length: if circular coaks, they are placed from 18 inches to 2 feet apart, with their outsides the same distance as the tabling from the side of the post. The false post in most foreign ships extends the whole length of the post, and may be considered as a backing.

False Rail, a piece brought on the upper part of the main head rail to strengthen it; it is bolted through the main rail with bolts about two feet apart (see Head).

Fashion-piece (Swedish, *ransoms timmer*; Dan. *ransonholter*; Dutch, *randsoenhouten*; German, *randsomholzer*; French, *estains*; Italian, *alette*; Spanish, *aletas*, *brazales*; Portuguese, *mancos)* timbers that give the form or fashion of the after extremity, below the wing-transom, when they terminate the tuck (47); and with a stern frame partake of the form of the body with the transoms at their ends (43 and 44).

Fay, to fit close or to bring two surfaces to conform to each other, so that there may not be any perceptible space between them.

Fid (Swedish, *sluthult*; Danish, *slutholt*; Dutch, *slothout*; German, *schlosholz oder schlotholz der stengen*; French, *clef du ton du mât*; Italian, *cassacavallo*; Spanish, *cunna*; Portuguese, *cunha dos mastareos)* a bar of wood or iron used to support the weight of the topmasts and topgallant masts when erect, and to keep the bowsprit, in cutters, out, &c.

Fid-hole (Swedish, *slutgatt*; Danish, *slutgat*; Dutch, *slotgat*; Germ. *schlosgat, oder schlotgat der stenge*;

French, *trou pour le clef du ton de mât*; Italian, *pertuso o ribasso dell'albero*; Spanish, *buraco ó ojo de la cunna*; Portuguese, *buraco de cunha)* mortises in the heels of topmasts, topgallant masts, &c. (383, 400, and 414).

FIFE RAIL, a rail formerly above the planksheer, let on timber heads, at the quarter deck and forecastle, and above the taffrail (110 and 120) (see RAILS).

FIGURE (Swedish, *skepps bild*; Danish, *löven eller figuren af skibet*; Dutch, *leeuw van het schip*; German, *bild des schiffs*; French, *la figure*; Italian, *figura di prua*; Spanish, *el leon, la figura de proa*; Portuguese, *a figura de proa)* the principal ornament of carved work at the head of the ship.

FILLINGS, pieces of timber placed wherever solidity is required, as pieces between the timbers of the frame (65) for the chain and preventer bolts to pass through, &c.

Fillings between the Cheeks (Swedish, *kam*; Dan. *kam*; Dutch, *kam*; German, *kam zwischen den schliessknien des galjons*; French, *remplissage entre les jottereaux, frise de l'éperon*; Italian, *riempimenti frà gli scarmoti della polena*; Spanish, *taco ó moldura entre las curvas bandas*; Portuguese, *ornato del talha)* pieces of fir worked so as to fill up between the cheeks. When the bolsters of the hawse or naval hoods are between the cheeks, these fillings extend from them to the block of the figure; if not, the fillings extend to the after end of the cheeks.

Fillings in the Openings, between the timbers of the frame (13, and from 279 to 283).

FILLING TIMBER, or FILLING FRAMES (Swedish, *timmer*; Dan. *fyllings-spant*; Dutch, *vulling spant*; Ger. *füll-spann füllungs-spann*; French, *couple de remplissage*; Italian, *quaderno di riempimento*; Spanish, *cuaderna de enchimiento, cuaderna intermedia*; Portuguese, *baliza de encher, madeira de encher* (67).

FILLING TRANSOM (see TRANSOM) this transom is now done away with, as an unnecessary consumption of scarce timber (41).

FINISHING, ornamental work for forming a finish to the upper and lower parts of the quarter gallery; those below are called the *Lower Finishings* (Swedish, *nedre delen af gallerien*; Danish, *det underste af en side-gallerie*;

Dutch, *voet van de zyde-galderyen*; German, *schwanz der seiten gallerie*; French, *cul de-lampe des bouteilles*; Italian, *pié dei giardini*; Spanish, *pié del jardin*; Portuguese, *pé do alforge)*: and those above, the *Upper Finishings*.

Fillet, a small square moulding which accompanies or crowns a larger. Also a strip of fir nailed to stop the different bulkheads of the cabins in their place.

Fir (Swedish, *furu*; Dan. *fyrr*; Dutch, *vuurenhout*; German, *fohren-holz*, *tannen-holz*, *fichten-holz*; French, *sapin*; Italian, *pino*; Spanish, *pino*; Portuguese, *pinho*) timber used for many purposes in ship building, and for making masts and yards. This timber is of various species, as the *Pinus Sylvestris*, the wild pine or Scotch fir; it grows principally in Denmark, Norway, and Sweden, and is that timber from which the white deal is cut. The *Pinus Strobus* or Weymouth pine, commonly called the white or masting pine; it grows in North America, and from it the single-tree masts and bowsprits are principally made, on account of the size to which it grows. The *Pinus Larix*, or the larch: this timber is of quick growth, and is a native of the Alps and Appenine mountains, though a considerable quantity of it is grown in Scotland, and has been used in ship building. The *Pinus Picea*, the silver fir tree or pitch tree: this timber is most common in Norway, and in some of the mountains of Scotland; from it the yellow deal is cut. The *Pinus Abies*, or spruce fir: this timber is one of the principal productions of the woods in Norway and Denmark, and is of close texture; the white deal is cut from it. This species of fir has likewise been grown in Scotland, and been used in ship building. And the *Pinus Canadensis*, or Canada spruce: this timber grows to a considerable size, and is a native of North America.

The fir from Prussia, Dantzic, Norway, and especially about Riga, is much esteemed; the Prussian and Dantzic for the flats of weather decks, and the Norway and Riga for masts. Though the red pine from North America is considered but little inferior, Riga is now principally used for topmasts, while the North American fir, as the red, white, and yellow pines, are used for standing masts.

Fire Boom (see Booms).

Fire Hearth, a machine placed in the galley for the convenience of cooking. It is composed of a grate, oven, and boilers.

Fire Ship (Swedish, *brännare;* Danish, *brander;* Dutch, *brander*, *brandschip;* German, *brander*; French, *brûlot;* Italian, *brulotto;* Spanish, *brulote;* Portuguese, *brulote)* a ship having combustible materials on board, that they may be readily set on fire, to produce a conflagration in the enemy's fleet, &c. and that they may be easily entangled with the enemy's rigging, the yards are fitted with grappling irons and sheer hooks.

Fire Room, the room that contains the combustible materials, fitted between the uppermost deck and deck below. This room has funnels connected with it, for communicating the fire to the rigging; the port lids on each side are hung on the lower part, and have placed against them iron chambers, which at the time of the firing of the ship blows them out. A sally-port on each side, put aft the bulkhead of the fire-room, is formed for the retreat of the officer after the train is set on fire.

Fishes, fore and after and side fishes, or side trees (Swedish, *skălar;* Danish, *vanger;* Dutch, *zwalpen;* German, *schwalpen;* French, *jumelles d'assemblage;* Italian, *galapazze;* Spanish, *jimelgas;* Portuguese, *chumeas meas de uniaom)* (330 to 334).

Flat-soled Fish (466).

Front Fish (353).

Fish Room, a room in the after hold, used in general for stowing spirits. It lies between the spirit and powder room, or after magazine.

Fixed Blocks (see Blocks).

Fixed Bolts (see Bolts).

Flairing, to fall out from the main breadth, the reverse of falling or tumbling home (see Bow).

Flats. The frames that have the same area as the greatest transverse section, are called flats, and the greatest transverse section is called dead flat (69).

Flight, to rise suddenly; as what the cathead is above a horizontal line is called the flight of the cathead; or what the cheeks curve above the sheer before the stem, is called the flight of the cheeks; or what the transoms,

at their ends, are from an athwartship line at their breach, is called the flight of the transoms; whereas what the floor rises above a horizontal line, is called the rise of the floor.

FLOOR. The floor is considered that part of the ship, on each side of the keel, that would be in contact with the supporting surface when inclined; and according as the floor will allow her to incline, it is said to be *Flat* (Swedish, *flat bătnstăck*; Danish, *plat bundstok*; Dutch, *buikstuk in't vlak*; German, *ein flaches oder plattes bauchstück*; French, *varangue plate*; Italian, *matera piana, majer piano*; Spanish, *varenga llana*; Portuguese, *caverna chata ou plana)*: or *Rising* (Swedish, *resande bătnstăck*; Danish, *reisende bundstok*; Dutch, *twill, piekstuk*; German, *eingezogenes bauchstük*; French, *varangue acculée*; Italian, *matera levata*; Spanish, *varenga de levanta*; Portuguese, *cavernas que ficaom perto da roda de prôa e cadaste)* (61).

FLOOR TIMBERS (Swedish, *bătten-stăcken*; Danish, *bundstokken*; Dutch, *buikstuk*; German, *bauchstück*; French, *varangue*; Italian, *matera, legno di piano, piana (gen majera)*; Spanish, *un plan, una varenga*; Port. *caverna)* (60 to 64).

FLOOR HEADS (Swedish, *kimming*; Danish, *kimmingen af et skib*; Dutch, *kim, kimming*; German, *kimm oder kimming des schiffs*; French, *fleurs de vaisseau*; Italian, *fiori della nave, intiunte*; Spanish, *cantos del pantoque*; Portuguese, *cantos do fundo do navio)* sometimes called rung heads, the outer ends of the floors.

FLOOR RIBBAND, the ribband next below the floor head (70) (see RIBBANDS).

FLUSH, to be fair, or any parts being on the same surface.

FLUSH-DECK (see DECK).

FOOT SPACE RAIL, the lower rail of the balcony, or stern gallery, or the rail into which the ballustrades step, when there is no pedestal rail (see BALCONY).

FOOT WALING or FUTTLING (see CIELING).

FORE, distinguishes the several parts of the ship that lie towards the stem.

FORE AND AFT, in direction of the ship's length, ranging from end to end.

FORECASTLE (see DECK).

FORE FOOT (27).

FORELOCK (Swedish, *knapar*; Danish, *knapper*; Dutch, *knaapen*; German, *knapen*; French, *laquets de clous*; Italian, *tacchetti dei chiavi*; Spanish, *taquets ó tojinos por los clavos*; Portuguese, *tacos ou cunhos dos cravos)* a thin circular or straight wedge of iron, made to pass through a mortise at the point of a bolt, to prevent its drawing when a direct strain is brought upon it (see BOLTS).

FORKED BEAMS, beams placed in the wake of the hatchways and masts, on account of the great space between the main beams in these places. They formed an inflected curve, so as to be united to the side of the beam, at the midship end; and to have their side ends in the middle, between the two beams, they were placed between.

FRIEZE, thin deal placed between the beams, over the fore and aft bulkheads of the cabins.

FRAME (Swedish, *spant rigtspant*; Danish, *rigtspandt;* Dutch, *rigt-spant, scheer-spant*; German, *richtspann, scheer-spant*; French, *couple de levée*; Italian, *quaderno principale*; Spanish, *cuaderna principal*; Portuguese, *baliza principal*) (65) without the filling frames.

FRAMING (see BULKHEADS).

FURRENS or FIRRINGS, pieces brought on to fashion, or make up the deficiency of timber, the moulding way.

FUTTOCKS, single timbers in the frame (66); as the *First Futtock* (Swedish, *zittror*; Danish, *ziters*; Dutch, *zitters*; German, *sitzer*; French, *genoux*; Italian, *forcami del fondo, stamenali*; Spanish, *estemenaras*; Portuguese, *bracos primeiros)*: *Second, Third, and Fourth Futtocks* (Swedish, *uplängor*; Danish, *oplanger*; Dutch, *oplanger*; German, *auflanger in einem spann*; French, *allonges*; Italian, *stamenali, slongatori*; Ven. *forcameli*; Spanish, *jenoles, ligazones de las cuadernas*; Portuguese, *os bracos segundos, terceiros, &c. das balizas)*.

FUTTOCK RIDERS (Swedish, *katsporets uplangor*; Danish, *katsporenes oplanger*; Dutch, *de oplanger van de katspooren stuinders*; German, *auflanger der katspuhren*; French, *allonges de porques*; Italian, *stamenali delle porche*; Ven. *forcamli dei raisoni*; Spanish, *jenoles de las bularcamas*; Port. *bracos dos prodigos do poraom*) (264).

GAFF (Swedish, *gaffel*; Danish, *gaffel*; Dutch, *gaffel*; German, *eine gaffel*; French, *vergue à corne*; Italian, *pico*; Spanish, *pico*; Port. *carangueia* (448).

Trysail Gaff (452).

GALLERY. The stern gallery is a balcony projecting from the stern, mostly formed by ballustrades which extend from side to side, fixed in two rails; the upper called the breast rail, and the lower one the footspace. This gallery, sometimes called the stern walk, is limited on the fore part by a partition called the skreen bulkhead, which is a framed bulkhead, and has lights and doors fixed in it (see BALCONY).

Quarter Galleries (Swedish, *gallerie;* Danish, *side gallerie;* Dutch, *zyde-gallery;* German, *obere oder offene seiten-gallerie;* French, *les clavecins de la galerie;* Italian, *giardino;* Spanish, *jardin;* Portuguese, *alforgee)* are on the side of the ship connected with the stern: they are principally for the convenience of water closets and for ornament. In three deck ships, they are called the upper, lower, and middle gallery.

The galleries are formed by rails, stools, munions, birthing, finishing, and the lights. The *Rails* are distinguished, those immediately under the lights, by the rim rails, as the lower, which is connected with the upper counter rail of the stern, middle, and upper rim rails; the rail next below the lower rim is called the lower stool rail, and is connected with the lower counter rail of the stern; those above the lights are called stool rails, according as they are placed as upper and middle stool rails; the rails over the upper finishing are called upper finishing rails, or rails to fret work, as the two small rails and part between them is called the fret work; the rail below the lower stool is called the lower finishing rail. The *Stools* are several breadths of plank bolted to the ship's side, for giving the form of the outer part of the galleries, and forming the flooring of each gallery; their outer part is an arc of a circle, for the convenience of sliding the lights, the fore and aft line being a tangent to it at the after part of the gallery, and intersecting the line of side at the length of the gallery forward. The *Munions* are the pieces that pass between the lights and form the side of them; their upper

ends let into the stools, and to the lower gallery, rest upon the water table that is brought upon the upper part of the the rim rail. The *Birthing* is the part that encloses the quarter except in place of the lights. The *Lights* are formed into sashes and mock lights; the sashes have glass in them and slide, the mock lights are blank part to make the quarter uniform outside. The finishings are the upper and lower parts (see FINISHINGS).

GALLEY (Swedish, *cabbysan;* Danish, *kabyssen;* Dutch, *kombuys;* German, *kombüse;* French, *cuisine;* Italian, *fogone*, *fuocone;* Spanish, *fogon;* Portuguese, *cozinha)* the place appropriated for the fire hearth and cooking (see FIRE HEARTH).

ROW GALLEY (Swedish, *gallere;* Danish, *galeje;* Dutch, *galey;* German, *galeere;* French, *galère;* Italian, *galera;* Spanish, *galera;* Portuguese, *galé)* a flat-built vessel, in general with one deck, and navigated both with oars and sails; they are most common in the Mediterranean.

GALLEY (see BOATS).

GALLIOTE (Swedish, *galliot*, *galliotte eller galleoth;* Danish, *galliot;* Dutch, *galjoot;* German, *galjote*, *galjotschiff;* French, *galiote Hollandoise;* Italian, *galeota Ollandese;* Spanish, *galeota del norte;* Portuguese, *galeota do norte*, *huma fandarga*) a Dutch ship with a lofty and round stern.

GAMMONING-HOLE, the hole for the gammoning of the bowsprit to pass through; it is placed between the cheeks.

GANG-BOARD (Swedish, *ställning;* Danish, *stilling*, *stilladse;* Dutch, *jok*, *juk;* German, *jock oder joch;* French, *échaffaud;* Italian, *ponte*, *bazigo;* Spanish, *andamios;* Portuguese, *andaimes)* several breadths of deal bolted together, formerly used for a passage on each side from the quarter deck to the forecastle; likewise a board used to pass in and out of a boat.

GARBOARD STRAKE (Swedish, *sandbords-planka;* Danish, *spunningsplanken*, *kiölplanken;* Dutch, *kielgang;* German, *kielgang;* French, *gabord;* Italian, *toello;* Spanish, *primera tabla del bordo exterior*, *tabla de la quilla;* Portuguese, *taboa do resbordo)* the lower strake of the plank of the bottom (102, 129, and 130).

Garland, or Shot Garland (Swedish, *kul-räckar*; Danish, *kugle-rekker*; Dutch, *kogel-rekken*; German, *kugel-recken*; French, *petit parquet pour les boulets dans les entre deux de sabords*; Ital. *latas de baleria*; Spanish, *rastrelliera da palle*; Portuguese, *cheleira de balas)* pieces of oak or beech plank, with holes formed in them, fastened round comings and head ledges of the hatch and ladderways, and sometimes between the ports, for placing the shot for immediate use.

Googings or Gudgeons (Swedish, *fingerlingar*; Danish, *roer lykkar, fingerlinger*; Dutch, *duimelingen*; German, *fingerlinge*; French, *femelles ou femelots*; Ital. *femine*; Spanish, *hembras*; Portuguese, *fêmeas do leme)* the hinges upon which the rudder turns; those fastened to the rudder are called pintles, and those to the ship braces (Note 11).

Goose Neck (Swedish, *svanhals*; Danish, *svane-hals*; Dutch, *zwaanenhals*; German, *schwanenhals, an einem gieck-baum*; French, *crochet de fer fixé au bout interieur d'un gui, et par le moyen duquel le gui tient à son mât*; Italian, *gancio della boma d'una randa*; Spanish, *gancho de la botabarra*; Portuguese, *gancho do bome)* an iron hook, placed at the after end of the main channel, with a strap to clasp it, for stowing the swing boom or a topsail yard.

Goose Neck is likewise an iron cleat placed on the fore end of the tiller to support it.

Gratings (Swedish, *trall*; Danish, *röstverket*; Dutch, *roosterwerk*; German, *rosterwerk*; French, *caillebotis*; Italian, *quartieri*; Spanish, *jareta, cuartel de enjaretado*; Portuguese, *xadrezes des escotilhas)* the covering of the hatchways, with a lattice covering to admit light and air; they are formed by ledges that lie athwart, and battens let into them lying fore and aft.

Gripe, a piece of elm or beech scarphed to the lower end of the knee of the head, to make a finish with the fore foot; it forms an abutment (27) against the foremost piece of keel, and is fastened with bolts, that pass no further into the stem than the rabbet, and a mixed metal plate brought on each side, called the horse shoe, on account of its form.

Gunwale (Swedish, *skandäck*; Danish, *skanddækket*; Dutch, *schamdek, schandek*; German, *schanddeck oder schanddeckel*; French, *plat-bord*; Italian, *orlo della nave*; Spanish, *regala, solera*; Portuguese, *alcatrate*) (107 to 113).

Hair Bracket (see Brackets).

Half Breadth Plan (see Draught).

Half Ports (Swedish, *lösa stykeportar*; Danish, *löse stykporter*; Dutch, *uitvoering van de stukpoorten*; German, *ausfutterung der stückpforten*; Fr. *faux mantelets, faux sabords*; Ital. *falsi portelli*; Span. *arandelas de la artilleria*; Port. *oculos das portinholas das pessas*) shifting shutters fixed in the stops of those ports, which have no hanging lids. Those to the quarter deck and forecastle ports are in general in one, and made of two thicknesses of slit deals, and to the ports for the long guns have holes in them for the gun to run out; and those to the upper deck, in two parts called buckler half ports; for long guns, the lower part is to the center of the gun, when run out and levelled, as they have a hole in them that fits close round the guns; and to carronades, to the under side of the gun, if not too low, that they may be fixed over them. The lower piece of these half ports is of fir and in one piece, to fill up the stops; with a rabbet taken out of its upper edge, to receive the upper part, and with two strengthening bolts driven up and down through it. This piece is in general kept in its place by sliding bolts. The upper part is made commonly of whole and slit deal, the whole deal up and down, and the slit deal, to cross it, fore and aft.

Half Timbers, the short timbers before and abaft the floors, in the cant bodies, which correspond with the shift of the heads in the square body.

Hammock Rack, battens, with scores taken out of them at 14 inches distance, or with stops fixed to them; they are nailed to the side of the beams, for the sailors to hang their hammocks to.

Hammock Stanchions, iron stanchions fixed in the waist between the drifts and upon the barricadings, for stowing the hammocks between; they are in general made with horns at their upper ends to receive a small rail; if

not, they have an eye for a ridge rope. The two arms of these stanchions are made to spread, according as they are to stow one or two hammocks abreast.

HANCE, the sudden breaking in from one form to another, as when a piece is formed, one part eight square, and the other part cylindrical, the part between, where these different forms terminate, is called the hance, or the parts of any timber where it suddenly becomes narrower or smaller.

HANGING, the same as sheer, or a bending down (99).

HANGING KNEE (see KNEES).

HARPINS, pieces formed to the shape of the body, and fixed at each extremity, for keeping the frames in their proper position until the planking is brought on (74).

HARRIS or ARIS PIECES, are pieces cut to a triangular form.

HARRIS EDGE, the same as cypher edged, or when the edges are cut to form an acute angle with the sides, as the plank to the well and shot locker bulk heads (see BULKHEAD).

HATCHES (Swedish, *stulplucka;* Danish, *stulp luge;* Dutch, *stulp luik;* German, *stulp-luken;* French, *panneaux à boite;* Italian, *boccaporta da incassare;* Spanish, *escotilla ó cuartel a encaje;* Portuguese, *quartel que encaixa)* the coverings for the hatchways; or if made with ledges (Swed. *lucka, falldör eller locket af en lucka;* Dan. *luge som paalægges;* Dutch, *luik, lucken-dekzel;* German, *luke, lukendeckel, lukenklappe;* Fr. *panneau d'écoutille;* Italian, *coverchio della boccaporta;* Spanish, *cuartel de la escotilla;* Portuguese, *quartels das escotilhas)*; and when the comings and head ledges have a rabbet on the outer parts, and the covering has a rim that circumscribes them, in this rabbet, they are called *Cap Scuttles* (Swedish, *spring lucka;* Danish, *spring luge;* Dutch, *spring luik;* German, *spring luke oder lose luke;* French, *écoutillon à panneau;* Italian, *piccola boccaporta nella grande;* Span. *escotillon en un cuartel;* Portuguese, *escotilhaom).*

HATCHWAY (Swedish, *lucka;* Danish, *luge;* Dutch, *luik;* German, *luke;* French, *écoutille;* Italian, *boccaporta;* Spanish, *escotilla, boca de la escotilla;* Portuguese, *escotilha)* passages from one deck to the other, and into

the hold of the ship. The principal hatchways are the *Main Hatchway* (Swedish, *storluckan;* Danish, *stor lugen;* Dutch, *het groot luik;* German, *die grosse luke;* French, *grande écoutille;* Italian, *boccaporta maestra;* Spanish, *escotilla mayor;* Portuguese, *escotilha grande): Fore Hatchway* (Swedish, *forluckan;* Dan. *forlugen;* Dutch, *het voor luik;* German, *vor-luke, kabelgats-luke;* French, *écoutille de la fosse aux cables;* Italian, *boccaporta della fossa delle gomene;* Spanish, *escotilla de prua, del pannol de los cables;* Portuguese, *escotilha de proa):* and *After Hatchway* (Swedish, *akterluckan;* Danish, *agter lugen;* Dutch, *agter luik;* German, *hinter-luke;* French, *écoutille de l'arrière;* Italian, *boccaporta di popa;* Spanish, *escotilla de popa;* Portuguese, *escotilha de popa).* The other passages that do not communicate with the hold, are called ladderways.

HAWSE HOOK (Swedish, *klysband;* Danish, *klysbaand;* Dutch, *kluisband;* German, *klus-band;* French, *guirlande des écubiers;* Italian, *busarda delle cobie*; Spanish, *busarda de los escobenes*; Portuguese, *busarda dos escovoens)* the breast hook at the hawse holes.

HAWSE HOLES (Swedish, *klys, klysgatorna*; Dan. *klyds-huller*; Dutch, *kluisgaten*; German, *klusen order klüsgaten*; French, *écubiers*; Italian, *cobie, occhj*; Span. *escobenes*; Portuguese, *escovoens)* the holes at the fore part of the ship through which the cables pass.

HAWSE PIPES (Swedish, *klysbussar*; Danish, *klysbösser*; Dutch, *kluisbossen*; German, *klüs-buchsen*; Fr. *une boîte au tuyau de plomb dans les écubiers*; Italian, *il piombo delle cobie*; Spanish, *el forro ó canal de plomo en los escobenes*; Portuguese, *o forro de chumbo nos escovoens)* thick lead pipes that line the hawse holes.

HAWSE PLUGS (Swedish, *klys proppar*; Danish, *klyds-propper*; Dutch, *kluis proppen, teersjes*; German, *teersjen zu den klüssen*; French, *tampons d'écubier*; Ital. *tappie delle cobie*; Spanish, *tacos de los escobenes*; Portuguese, *tacos dos escovens)* plugs made to fit the hawse holes, to prevent the passage of the sea through them when the cables are unbent.

HAWSE PIECES (Swedish, *bogtimmer*; Danish, *bovstykkërne*; Dutch, *boegstukken, aposteln*; German, *bug-*

stucke oder bugholzer; French, *alonges d'écubiers*; Ital. *apostoli*; Spanish, *astas de proa*; Portuguese, *columnas de proa)* (75 and 76).

HEAD, the upper end of any piece of timber, as the heads of the timbers of the frame (NOTE 27), bitt heads, timber heads (Swedish, *pällar*; Danish, *pullerter*; Dutch, *polder*; German, *polder oder pöller*; French, *têtes des alonges de revers*; Italian, *bittoni*; Spanish, *posturas escalamotes*; Portuguese, *cabecos)*, bollard heads, &c.

HEAD (Swedish, *gallion*; Danish, *gallion*; Dutch, *galjoen*; German, *das galion oder galjon eines schiffs*; French, *poulaine*; Ital. *polena*; Span. *las alas de proa*; Port. *beque)* the whole of the fore part of the ship, with the bows, when used in the enlarged sense of the word, but here it is intended to signify the finishing of the fore part, which consists of the knee of the head (see CUTWATER), figure (see FIGURE HEAD), head rails (Swedish, *gallions ziegler*; Danish, *gallions reilinger*; Dutch, *regelingen van het galjoen*; German, *regelingen des galjons*; French, *lisses de herpes*; Italian, *soggie dello sperone*; Spanish, *perchas*; Portuguese, *perchas)*, and cheeks (see CHEEKS).

The knee of the head (A, fig. 9) is an assemblage of pieces tabled or coaked together, and brought on the fore part of the stem, projecting forward from about 1-13th to 1-11th of the length on the deck; it is composed in general of three principal pieces, the stem piece (z), main or lacing piece (z'), and bobstay pieces (z''). The *Stem Piece* extends from the lower end of the knee, where it has a scarph for the gripe, and sufficiently up to have a hole cut in it for the collar of the main stay: *the Main or Lacing Piece* has its upper part forming the lacing for the back of the figure, and in general extends down to form an abutment into the stem piece, and to give the form to some distance up, of the fore part of the knee: the *Bobstay Piece* has an abutment in the main piece and extends up to the under side of the figure, and has its fore edge to the form of the fore part of the knee. The other pieces that make up the breadth and form of the knee are of a size and form most convenient. As the several pieces are placed in their position, two or three treenails are driven into each, to keep the knee together till the bolts are driven.

Upon the upper part of the knee a timber is brought, called the lacing (y), which abuts against the stem pieces, and has a tenon into it; this piece extends forward so as to have 1 or 2 bolts through it from the fore part of the knee. *The Figure* is the carved ornament at the extremity of the knee, in general having an allusion to the ship's name. *The Head Rails* are called the main and small, or middle rails: the main rails extend from the back of the figure to the bow of the ship; sometimes to the supporter of the cathead, or snapeing against the bow, when they are called straight or sheer rails, according as they are formed; at other times, which was common formerly, they have a sudden curve at the after end, and return against the fore side of the cathead, when they are called circular rails. The main rails are secured, at the fore end, by an iron knee, which bolts through the two rails and the lacing of the figure, and at the after end, by being bolted to the bow. They are likewise secured by cross pieces, that lie from side to side and lap on each rail. The after cross piece has on each end a knee against its aft side; and to the inside of the rail, between the cross pieces, are placed pieces in a fore and aft direction, something less than half the diameter of the bowsprit from the middle line, when the bowsprit is above them, called fore and aft carlings; they score into the cross pieces, about from one inch to an inch and half; and from the fore and aft carlings to the rails, and from the bow to the rails, abaft the after cross pieces, are let down small ledges to form the platform, having their lower edges made to a sharp, that they may oppose as little resistance as possible when the sea strikes them; and to keep them down, an iron plate is fastened over their upper ends. The small or middle rails are one or two in number, according to the size of the ship; they are placed at equal distances between the lower side of the main rails and upper side of the cheeks; their fore end abuts against the hair bracket (see BRACKET), and their after end against the bow; they are let into the pieces called the head timbers, which are placed up and down in the direction, or with a little more rake than the stem; and which extend from the lower side of the main rail to the upper part of the upper cheek, and are bolted through them with one

bolt. *The Cheeks* are two or three on each side for supporting the knee of the head; they have one arm bolted to the bow and the other through the knee. The bolts through the bow go through and are clenched on the inside, and those in the knee go through each cheek and its opposite; they are driven from each side alternately, and are clenched on the opposite side. The cheeks have ornamental moulding struck on their outer edges. The fore end of the upper one, which terminates with a scroll or volute, at the back of the figure, is called the hair bracket; and the fore end of the middle if three, or the upper if two, terminates with a scroll or volute under the figure.

HEAD LEDGES (see COMINGS).

HEAD RAILS (see HEAD).

HEAD TIMBERS (see HEAD).

MAST HEAD (see MAST).

HEEL, the lower end of any piece or timber, as the heel of the timbers, *heel of the mast* (Swedish, *mastfot*; Danish, *mastfod*; Dutch, *hiel van een mast*; German, *hiel eines masts*; French, *pied d'un mât*; Italian, *pié d'un albero*; Spanish, *mecha*; Portuguese, *pé do mastro)*, *heel of the topmast* (Swedish *stăngens, häl eller fot*; Danish, *fod eller, häl af en stæng*; Dutch, *hieling van de steng*; German, *hiel oder hieling der stenge*; French, *talon d'un mât de hune*; Italian, *cogion d'un albero di gabia*; Span. *coz del mastelero*; Portuguese, *coz do mastareo)*, &c.

HEEL, to incline.

HELM (Swedish, *roder, ror, styre*; Danish, *roer eller ror*; Dutch, *stuur, roer*; German, *steuer oder ruder*; French, *gouvernail*; Italian, *timone*; Spanish, *timon*; Portuguese, *leme)* the rudder, tiller, and wheel, or the machinery that steers the ship.

HELM PORT (Swedish, *hăl för roderpinnen*; Dan. *hennegat eller hul for roerpinden*; Dutch, *hennegat*; German, *hennegat*; French, *jumière*; Italian, *pertuso della manovella*; Spanish, *limera del timon*; Portuguese, *abertura por onde entra a cabeca do leme na almeida)* the hole through which the head of the rudder and tiller passes.

HELM PORT or COUNTER TRANSOM (Swedish, *bofven hackbalk*; Danish, *ovre hœkbielke*; Dutch, *boven*

hekbalk; German, *obenheck-balken*; French, *barre d'écusson ou barre ou bout de l'étambot*; Italian, *controtriganto*; Spanish, *contrayugo, sobreyugo, cruz*; Portug. *barra que forma o batente superior das portas da praia de armas)* a transom between the wing and middle or upper deck transom, with a cast to bring it below the helm port. This transom was bolted through the counter timbers, and was kneed at each end. It is now left out, on account of the large timber required to make it, and iron braces placed instead.

Hogging (see Note 2).

Hold (Swedish, *rummet*; Danish, *lasten*; Dutch, *ruim*; German, *raum eines schiffs*; French, *la cale*; Italian, *stiva*; Spanish, *bodega*; Portuguese, *poraom)* the part of the interior cavity of the ship below the lower deck or orlop, which is reserved for the ballast, water, and provisions (7).

Hood. The foremost and aftermost plank in each strake, both inside and out, are called the fore and after hoods (96).

Hood, the covering over the chain pumps.

Hooding Ends (96).

Hooks, *Breast Hoops* (Swed. *bogband*; Dan. *bogbaand*; Dutch, *boegbanden, kropwrangen*; Germ. *banden im bug oder bug-banden*; Fr. *guirlandes*; Ital. *busarde*; *(Venet. zogie)*; Span. *busardas*; Port. *busardas do poraom)* Hooks are breast or deck hooks. The *Breast Hooks* are large compass timbers, lying across the apron or stemson inside, at an equal distance on each side, for uniting and supporting the bows. They are in length from about 10 to 18 feet, and bolted through both bows with from about 7 to 13 bolts, according to their length or class of ship; the bolts in the throat are placed nearer to each other than those towards the arm, and sometimes they are made to cross, that is, the two middle bolts are placed from about 6 to 12 inches apart; and are so disposed, as to their direction, to come out on the opposite side, outside the bow, to which they are placed npon the hook. The breast hooks are now in general made, so as to avoid great consumption of large and scarce timber. They are composed (Fig. 34) of two pieces scarphed together at the middle, and

united by an iron brace. The breast hooks are placed between the different decks, and below the lowest deck, and are sometimes named according to their situations; as the *Hawse Hook* (see Hawse Hook and Hook under the Bowsprit) (Swedish, *bogsprotband;* Danish, *bogsprytbaand*; Dutch, *boegsprietband*; German, *bugspriet-band*; French, *guirlande du beaupré*; Italian, *busarda del copresso*; Spanish, *busarda del baupres*; Portuguese, *busarda do gurupes).* The breast hooks below the lowest deck are placed nearly square to the body, and those between the decks, after the sheer of the decks. *Deck Hooks* are those upon which the fore ends of the deck rest; they have the round-up of the deck as well as the form of the inside of the bow (see Ekeing).

Hooking or Hook and Butt, is when the edges of the different planking work into each other, with a small abutment of about an inch to an inch and $\frac{3}{4}$, sometimes called tabling, to prevent extension (145 and 152).

Hoop. Hoops are used for different purposes; as bands, as the *Hoops of the Masts* (Swedish, *mastböglar*; Danish, *mastboyler*; Dutch, *bengels om de mast*; German, *masten-bugel oder bügel um die masten*; French, *cercles de mât*; Italian, *cerchj degli aberi*; Spanish, *sunchos de las palos*; Portuguese, *chapas dos mastras*) (321, 325, 338 and 341). *Hoops on the Pumps* (Swedish, *pumpboglar*; Danish, *pompböyler*; Dutch, *beugels tot de pomp*; German, *pumpen-bügel*; French, *cercles de pompe*; Ital. *cerchj della tromba*; Spanish, *sunchos de la tromba*; Portuguese, *chapas de bomba*) (see Pumps).

Hoops of the Capstan, and in the Partners of the Capstan (Swedish, *bogel i găngspels fiskar*; Danish, *boylen*; Dutch, *beugel in de vischer*; German, *bügel in den fischen des gangspills*; French, *cercle d'étambrai de cabestan*; Italian, *cerchio nelle fogonature dell'argano*; Spanish, *suncho en la fogonadura del cabrestante*; Portuguese, *chapa da ennora do cabrestante*) (see Capstan).

Clasp Hoops (341 and Note 68).

Joint Hoops. These hoops are similar to clasp hoops, excepting that they have joints on the opposite side to the clasp, to allow them to be opened for the ease of placing them on the mast, before they are set up; as in

some cases, if there were no joint, the hoop would be strained too much in placing it.

Horse, a cylindrical bar of iron extending from the fore side of the after end of the main rail of the head, or from the bow, to the back of the figure, with one or two iron stanchions for support. It was intended formerly as a guard, and had a rope netting, or canvass attached to it, but now a rail is brought above the horse and the head is birthed in with rabbetted deal of one inch and $\frac{1}{4}$ in thickness.

Horse Shoe, straps of mixed metal, in the form of an horse shoe, used for securing the gripe to the stem; there is one on each side placed immediately opposite to each other, that the bolts that fasten them may pass through both.

Hounding, the length of the mast from the heel to the lower part of the head (314).

Hound Pieces, pieces fixed to standing masts (319), cutters' masts (358), and topmasts (395).

Howker (Swedish, *hukare*; Dan. *huker*; Dutch, *hoeker*; German, *huker*; French, *houcre*; Italian, *sapata*, *ucaro*; Spanish, *ucaro*; Portuguese, *huquer*, *gangorra*, *charrua*) a Dutch vessel, from about 60 to 200 tons burthen, or more; they are rigged with a main and mizen mast.

Hoy (Swedish, *hoy*; Danish, *hoy*; Dutch, *heu*; German, *heu*) a vessel usually rigged as a sloop, but sometimes with a main sail without a boom, and in Holland with two masts; they are mostly used for carrying stores, water, &c. to ships in bays and roads, and carrying passengers and luggage from one place to another, along the sea coast. Small vessels thus defined are in some places called sloops, and in others, smacks, &c.

Hull (Swedish, *skrăf*; Danish, *skrov*; Dutch, *hol van't schip*, *lighaam*; German, *rumpf eines schiffs*; Fr. *corps*; Italian, *scaffo*; Spanish, *buque*, *casco*; Portuguese, *casco*) (1). The part of the hull below water is called the bottom or *Quick Works* (Swedish, *under skepp*; Danish, *under skibet*; Dutch, *onder schip*, *het schips onder water zynde deel*; German, *unter-schiff*; French, *œuvre vive*; Italian, *opera viva*; Span. *obra viva*; Portuguese,

obra viva) and upper or *Dead Works* (Swedish, *ofver skepp*; Danish, *over-skibet*; Dutch, *dood werk, huising, boven-schipt*; German, *ober schiff, oberwerk oder todte werk*; French, *œuvre morte*; Italian, *opera morta*; Span. *obra muerta*; Portuguese, *obra morta*) (1).

Jambs, broad pieces of oak fixed up and down on each side the captain's stove in flush-deck vessels; likewise, formerly, pieces for fixing the lights in the magazine.

Jeer Bitts (see Bitts).

Jeer Capstan (see Capstan).

Jib Boom (see Boom).

In and Out. The bolts that are driven through the ship's side, are said to be in and out bolts (206 & 207).

Inboard, within the ship. The profile is the elevation of the inboard work (see Draught).

Inner Post (Swedish, *folgare innan på akterstafven*; Danish, *indenstevnen paa agterstevnen*; Dutch, *binnenagtersteven*; German, *binnensteven hinten, oder binnenhintersteven*; French, *contre-étambot intérieur*; Italian, *contra-asta interiore di poppa*; Spanish, *albitana del codaste*; Portuguese, *contracadaste*) (38, Note 12).

Joint, where two edges or surfaces unite.

Irons. *Studding-sail Boom Irons* (Swedish, *böglar til läseglets spiror*; Danish, *læsejlenes böyler*; Dutch, *lyzeils beugels*; German, *bügel der leesegelspieren*; Fr. *cercles des boutehors des bonnettes*; Italian, *cerchj dei bastoni dei cortellazzi e scopamare*; Spanish, *sunchos de los botalones de las alas y rastreras*; Portuguese, *arcos dos paos de cutelos e barredouras* (426 and 431).

Keel (Swedish, *köl*; Danish, *kiöl*; Dutch, *kiel*; German, *kiel eines schiffs*; French, *quille*; Italian, *chiglia, primo*; (*Vened. colomba*); Spanish, *quilla*; Portuguese, *quilha*) (15).

False Keel (see False Keel).

Keelson (Swedish, *kölsvin*; Danish, *kiölsvin*; Dutch, *kolsem, kolswyn, saad-hout*; German, *kolschwein, kolschwinn, kolsem oder saatholz*; French, *carlingue du fond du vaisseau*; Italian, *paramezzale*; Spanish, *carlinga, sobre-quilla*; Portuguese, *sobre-quilha*) (88 to 91).

Additional Keelson, a piece of keelson brought on each side, upon the floors, &c. under the main step, to

support the body against the stress of the main mast. It is of such a distance from the common keelson as to receive the ends of the step. It is coaked and bolted as the common keelson, except that the bolts pass through the floors or cross timbers, and outside planking.

KNEE (Swedish, *kna*; Danish, *knæ*; Dutch, *knie*; German, *knie*; French, *courbe*; Italian, *braccinolo, curva*; Spanish, *curva*; Portuguese, *curva*). Knees are timbers formed from the trunk and branch of the tree; they are called *Lodging* (Swedish, *vinkelknä*; Danish, *vinkel-knæ, horizontal leggende knæ*; Dutch, *winkel-knie, waterpas leggende knie*; German, *winkle-knie, schlafende knie, horizontale knie*; French, *courbe horizontale*; Italian, *bracciuolo orizontale*; Spanish, *curva valona, curva diagonal*; Port. *curva de abertona*) (199): *Hanging* (Swedish, *hängande knän*; Danish, *verticale knæer, op og ned staaende knæer*; Dutch, *op en neer staande knies*; Germ. *auf und neiderstehende knien, hängende knien, stech-knien*; French, *courbes verticales*; Italian, *bracciuoli verticali*; Spanish, *curvas de alto a bajo, curvas de peralto*; Portuguese, *curvas ao alto*) (199): and *Standard Knees* (Swed. *knän som sitta verticalt pă däcket*; Danish, *forkeerte knæer paa dekkene*; Dutch, *verkeerde knies op't dek*; German, *verkehrte knien*; French, *courbes verticales des ponts (dont une branche se cheville sur le pont)*; Italian, *bracciuoli verticali sopra le coperte*; Spanish, *curvas llaves*; Portuguese, *curvas do alto, dos chaves*) (204, 211, and 271).

Dagger Knee (see DAGGER KNEE).

Transom Knee (Swedish, *häck-knän*; Danish, *hæk-knæer*; Dut. *hek knies*; Germ. *heck-knien oder knien des heck-balkens und der spiegel-wrangen*; Fr. *courbes d'arcasse*; Italian, *bracciuoli delle alette e del tragante*; Span. *contra-aletas*; Portuguese, *curvas de palmejar*) a knee brought against the side of the ship and the foreside of each transom.

KNEE OF THE HEAD (see HEAD and CUTWATER).

KNIGHT HEADS (Swedish, *klyshultar*; Danish, *judas örne*; Dutch, *boegstukken van de kluisen, kluishouten, judes ooren*; German, *die bugstucke wodurch die klusen gebohrt sind oder die klusholzer*; French, *apôtres*;

Italian, *apostoli delle cobie;* Spanish, *astas de proa para los escobenes;* Port. *paos ou columnas dos escovoens)* (32).

Knuckle of the Counter (80).

Lacing (see Head).

Ladders (Swedish, *trappor;* Danish, *trapper;* Dutch, *trappen;* German, *treppen;* French, *échelles;* Italian, *scale:* Spanish, *escaleras;* Portuguese, *escadas)* frames used in ships for the convenience of ascending and descending from one deck to the other, similar to the stair cases in houses. The ladders are formed of two principal pieces, that extend from one deck to the other, called sides, lying at as great an inclination as the breadth of the ladder-way will allow, with proper head room; fitted between the sides, in groves or scores taken out of them, are pieces called the steps, lying after the deck, from 7 to 9 inches apart; what they are above each other is called the rise, and what the front edge of one step projects beyond the step above, is called the tread, which will be more or less according to the inclination of the sides.

Accommodation Ladder (Swedish, *fallreps-trappa;* Danish, *fald-rebs-trappe;* Dutch, *valreeps-trap;* German, *fallreepstreppe;* French, *escalier ou échelle de commandement;* Italian, *scala alla banda della nave;* Spanish, *escala del costado, escala real;* Portuguese, *escada do costado)* a ladder sometimes fixed at the gang-way outside, for the accommodation of ascending and descending the side of the ship.

Ladderways (see Hatchway).

Larboard Side (Swedish, *bagbord;* Danish, *bagbord;* Dutch, *bakboord;* German, *backbord;* French, *babord;* Italian, *sinistra della nave;* Spanish, *babor;* Portuguese, *babordo)* the left-hand side when looking forward.

Launch (see Boats).

Launch, the slip (14) upon which the ship is built, with the cradle and all connected with launching. While the ship is building, she is supported on blocks (14), but when she is to be launched, on an inclined plane laid on each side, to a declivity of from $\frac{7}{8}$ of an inch to one inch and $\frac{1}{8}$ in a foot, the smallest declivity to largest ships. These inclined planes are formed in general by laying first, lengthways of

the slip, one or more tiers of fir timber, two or more abreast, and upon them lying blocks, from two to four feet apart, to make up the height, so as to have the depth of the builgeways at least in the fullest part of the body, the inclined plane or ways to their proper inclination, and that the fore foot of the ship may clear at the bottom of the slip, or the slip where she floats. Then upon the blocks are laid, lengthways the slip, two or three breadths of plank called sliding plank, from three to four inches in thickness, made even at their upper surface, and with the butts of the different planks cut to a bevelling, so that the butts of the upper planks may lie over the lower, to prevent any part of the builgeways catching as the ship descends. When the inclined planes or ways are completed on each side, the builgeways which form the principal, or base for the cradle, are placed upon them, with their outer parts rather more than $\frac{1}{6}$ of the extreme breadth of the ship from the middle line. In the full part of the ship, the space from the builgeways to the bottom is filled up with solid pieces of fir, called fillings, or stoppings up; these fillings fit close on the builgeways, on the inside, but are left about $\frac{3}{4}$ of an inch up, on the out, for wedge-like pieces called slices; and before and abaft the fillings, a plank is likewise placed on the builgeways leaving it up on the outside the same as the fillings, and for the same purpose; then upon these planks, pieces of fir timber, called poppets, are placed endways up to the bottom, at the lower end fixing in scores taken out of the plank, and at the upper end faying to the bottom; to unite the poppets and fillings in one mass, a plank of 3 or 4 inches in thickness is brought on the outside, over their heels, extending to some distance along the fillings, and one or two others above, one up to the bottom, and the other in general in the middle between; these two planks are commonly called dagger planks. Between these planks short pieces of the same thickness, and in the direction of the poppets, are fitted between, and the whole fastened with nails and treenails to the poppets and filling. As far, at each end, as the poppets extend, and a small distance along the fillings, a plank is bolted to the bottom, to prevent their being forced out when they have to sustain the weight of

the ship. The edge of these planks, in general, forms a mitre with the upper edge of the upper dagger planks; and against the outer edge of this plank, and against the fillings, to give additional support, cleats are bolted to the bottom one over every poppet, or every other one, and one over the butt of each piece of filling, and 1 or 2 between. These cleats are fastened with 2 or 3 copper bolts at the lower end, and 2 or 3 nails at the upper. The holes for the bolts are in general bored the thickness of the cleats more than their length, into the bottom, in case it should be required to drive them up, after the cleat is off. A cleat is likewise placed on the fore side of the foremost poppet on the builgeways, and one against the bottom; the same is placed against the aft side of the after poppet.

When the whole of the cradle is fitted, it is taken apart, and the upper surface of the sliding plank and lower side of the builgeways are greased, by first paying it over with hot tallow, and then with train oil, after which with small portions of soft soap, at small distances apart. The cradle is then again refitted, and the wedge-like slices placed close together, between the filling and builgeways and the plank under the poppets and builgeways, and set in tight, so as to bring the weight of the ship on the inclined planes, or take the weight in part off the blocks.

To keep the cradle in the proper direction while the ship is descending, long strips of fir, from 5 to 6 inches square, are nailed on the sliding plank, without the builgeways, called ribbands; these are placed so as to be clear of the outside of the builgeways, at the upper end $\frac{3}{4}$ of an inch, and at the lower end one inch; and at the lower end of the ways one inch and $\frac{3}{4}$. These ribbands are well shored on each side, to prevent spreading. The upper piece of ribband is in general from 8 to 12 feet in length, and of oak, coaked to the sliding plank, as against its fore end, a shore, called the dog-shore, is fixed. The dog-shore abuts against this piece of ribband with one end, and against a cleat bolted to the side of the builgeways, called the dog-cleat, at the other: it has its fore end capped with iron.

In launching the ship, the shores against the body are taken down, and the blocks (14) under her keel, that support her while building, are regularly split out and removed, beginning with the after one. The ship is then brought to bear on the cradle, and that on the inclined plane which is on each side; then being thus supported, she has a tendency, by the force of gravity, to descend; but is still kept, till the time appointed for launching, from approaching towards the water, by the dog-shore and two or three of the foremost blocks, which remain to keep the strain from the dog-shore; two or more of which are allowed to remain, and are upset as the ship descends. When to be launched, the dog-shores are knocked down, and if the force of gravity does not overcome the adhesion and the presure on the blocks left under, the bed screws fixed against her gripe are hove till she moves; the ship will then descend with increased velocity, until she is borne by the water.

Laying off is the taking off from the draught and delineating upon a floor prepared for the purpose, in an extensive room called the mould loft floor, the different parts of the ship to the true size, so as to obtain the correct form of all the timbers that compose the frame (65) and other principal parts of the structure.

Leak (Swedish, *läcka*; Dan. *læk*, *lække*; Dutch, *lek*; Germ. *leck*; French, *voie d'eau*; Italian, *falla*; Span. *un agua*; Portuguese, *veia de agna)* a passage for the water through shakes, holes, or breaches in the bottom, sides, or decks. At the commencement of the leak, the ship is said to have sprung a leak.

Lean (see Clean).

Ledges (Swedish, *ribbor*; Danish, *ræbber*; Dutch, *ribben;* German, *ribben zwischen den deckbalken*; French, *borrotins*; Italian, *catene*; Spanish, *barrotes*; Portuguese, *barrotes*) (300 to 304).

Light Water Line (see Draught of Water).

Lignum Vitæ (Swedish, *porkenholt*; Danish, *pokholt*; Dutch, *pok-hout*; German, *pock-holz*; French, *gayac ou gaïac*; Italian, *legno santo*; Spanish, *palo santo*; Portuguese, *páo santo)* guaiacum or pockwood. The officinale, or common lignum vitæ, is that which is used

in the mechanical arts, and for ships. The shives of blocks, rolls, and sometimes circulars coaks, &c. are made of this wood.

LIMBER BOARDS (137).

LIMBERS or LIMBER HOLES (Swedish, *văghăl*; Danish, *lemme gater*; Dutch, *lokgaten*; German, *müstergaten*; French, *lumières, anguillères*; Italian, *bugi delle matere*; Spanish, *grueras de las varengas*; Portuguese, *boerias*) holes cut in the lower parts of bulkheads, lower parts of riders, &c. for a passage for the water.

LIMBER STRAKE (135).

LIPS OF THE SCARPHS, the end or thin part of the scarph.

LOAD WATER LINE (see DRAUGHT OF WATER).

LOCKERS, compartments built in general with one inch and ¼ deal, in cabins and store rooms.

SHOT LOCKERS (Swedish, *kulbackar;* Danish, *kuglebakker paa dæcket;* Dutch, *kogelbakken op't dek;* German, *kugel-backen, auf dem deck;* French, *petits parquets pour les boulets, sur le pont;* Italian, *parchetti per le palle sopra la coperta*; Spanish, *cajas o ronnadas por las balas;* Portuguese, *arcadas ou chaleiras pregadas nas cubertas para conter as balas)* lockers placed between riding bitts under the cross pieces, round the mast, &c. for placing shots ready for use.

LONG BOAT (see BOATS).

LOOVERED BATTENS, battens, fitted in frames, or between the stanchions, to different partitions, at such an angle as to admit air, and yet to prevent dirt from entering, or the apartment being exposed.

LUFF or LOOF, the roundest part of the bow (see BOW).

LUGGER (Swedish, *lugger;* Danish, *logger;* Dutch, *logger;* German, *logger;* French, *lougre;* Ital. *bastimento chiamato, loggre:* Spanish, *logger;* Portuguese, *logger)* a vessel having three masts for carrying lugsails; the yards are lateen, but hang nearly at right angles to the mast when hoisted.

MAGAZINE (Swedish, *krutdurkar;* Danish, *krudkammer;* Dutch, *kruid-kaamer;* German, *pulverkammer;* French, *soute à poudre;* Italian, *camera della polvera;*

Spanish, *pannol de polvera;* Portuguese, *paiol da polvera*) an apartment formed in large ships forward, and small ships aft, called the grand magazine. The larger class of ships have a small one aft, called the after magazine or powder room.

MANGER (Swedish, *vatubacken fram i bogen;* Danish, *vandbakken, pissebakken;* Dutch, *pisbak, waterbak;* Germ. *pisback, wasser-back;* Fr. *gatte;* Ital. *cassa delle cobie;* Span. *caja delle agua;* Port. *tanque das pelias*) a part separated across the bow, inside upon the working deck, with one or more heights of plank, to interrupt the passage of the water, that may come into the hawse holes, when heaving in the cable, or at other times. The separation is formed by planks, called manger boards, that are placed immediately within the hawse holes, or sufficiently forward that the bow chase gun may be worked. The boards are from 3 to 4 inches in thickness, and if more than one in height, they are rabbetted together; to receive their side ends, a chock is bolted to the bow, called the manger chock, and has a groove taken out of it, of a triangular form, for that purpose. When the manger boards are not fitted to extend from side to side, nor to fix in the bowsprit bitts, two stanchions are fixed for that purpose, called manger stanchions, equally on each side of the middle, and apart sufficiently for the bowsprit to pass between them. The manger boards are not permanently fastened, but have a stop placed over their upper edge, in the groove taken out of the chocks and stanchions, that they may be readily taken away when the flat of the deck wants caulking. Their edges are caulked, and a cant is fixed upon the deck againt their after edge, called the manger cant.

Manger Scuppers, scuppers placed in the after part of the manger, through the side of the ship, for carrying the water that comes in at the hawse holes into the sea.

MARGIN, a line at a parallel distance down from the upper edge of the wing transom, forming the lower part of a surface for seating the tuck rail; it terminates the ends of the exterior planking, or what is called the tuck.

Mast (Swedish, *mast*; Danish, *mast*; Dutch, *mast*; German, *mast*; French, *mât*; Italian, *albero*; Spanish, *palo*; Portuguese, *mastro*) (314).

Masts are distinguished into the *Main* (Swed. *stormasten*; Danish, *stormasten*; Dutch, *de groote mast*; German, *der grosse mast*; French, *grand mât*; Italian, *albero maestro*; Span. *palo mayor*; Portuguese, *mastro real, mastro grande*): *Fore* (Swedish, *focke masten*; Danish, *fokke masten*; Dutch, *de fokke mast*: German, *der fock-mast*; French, *mât de misaine*; Italian, *albero di trinchetto*; Spanish, *palo de trinquete*; Portuguese, *mastro real do traquete*) and *Mizen Masts* (Swedish, *mesans-masten*; Danish, *besans-masten*; Dutch, *de besaans-mast*; German, *der besahn-mast*; French, *mât d'artimon*; Italian, *albero de mezzana*; Spanish, *palo de mezena*; Portuguese, *masto real da gata ou da mezena*). These masts are *Made* (Swedish, *mast som är gjord af mer än et trä*; Danish, *mast som er giort af meere end et træe*; Dutch, *een mast van veel in malkandere ingevoegde stukken*; German, *ein zusammengesetzter oder aus mehrern strücken gemachter mast*; French, *mât composé*; Italian, *albero composto*; Spanish, *palo compuesto*; Portuguese, *mastro composto*) (315, and from 328 to 337) or of a *Single Tree* (Swedish, *mast af et stycke*; Danish, *mast af eet stykke*; Dutch, *mast die van een stuk is*; German, *ein aus einem stück gemachter mast*; French, *mât d'un brin ou d'une pièce*; Italian, *pidro*; Spanish, *palo macho*; Portuguese, *placa*) (318).

Topmasts (391 to 394) are the *Main* (Swed. *stor stängen*; Danish, *store stængen*; Dutch, *de groote steng*; German, *die grosse stenge, order grosse mars-stenge*; French, *grand mât de hune*: Italian, *albero di gabbia*; Spanish, *mastelero mayor*; Portuguese, *mastareo grande ou de gavia grande*): *Fore* (Swedish, *förstängen*; Danish, *forstængen*; Dutch, *de voor-steng, fok-steng*; German, *die vor-stenge, vormars-stenge*; French, *petit mât de hune*; Italian, *albero di parrochetto*; Spanish, *mastelero de proa ó de velacho*; Portuguese, *mastareo de velacho, do traquete ou da gravia menor*) and *Mizen* (Swedish, *kryss-stangen*; Danish, *kryds-stængen*; Dutch, *kruis-steng*; German, *kreuz-stenge*; French, *mât de perroquet de fougue*;

Italian, *albero di contramezzana*; Spanish, *mastelero de mezana*; Portuguese, *mastareo da gata).*

Lengthened Topmast (408).

Topgallant Mast (412). The *Main* (Swedish, *stor bramstängen*; Danish, *store bram-stœngen*; Dutch, *de groote bram-steng*; German, *die grosse bram-stenge*; French, *grand mât de perroquet*; Italian, *albero di pappafico*; Spanish, *mastelero de juanete mayor, ó de juanete grande*; Portuguese, *mastareo do joanete grande)*: *Fore* (Swedish, *for bramstängen;* Danish, *for bram-stœngen*; Dutch, *de voor-bram-steng*; German, *vorbram-stenge*; French, *petit mât de perroquet*; Italian, *albero di pappafico di parrochetto*; Spanish, *mastelero del juanete de velacho ó del juanete de proa*; Port. *mastarço do joanete de proa*) : and *Mizen* (Swedish, *kryss bramstang*; Dan. *kryds bram-stœngen*; Dutch, *de kruis-bram-steng*; Ger. *kreuzbram-stenge*; French, *mât de perruche*; Ital. *albero di cacaro o del belvedere*; Spanish, *mastelerito de periquito*; Portuguese, *mastareo da sobregata).*

Mast Carlings, large carlings fixed or let down on each side of the mast; they are placed at an equal distance from the middle line, and apart the diameter of the mast, and sufficient for wedging on each side; they score and face into the beams, before and abaft the mast, and lap on them about two-thirds the breadth of the beam, and are bolted with two bolts in each end.

Mast Partners, commonly called cross partners, pieces placed before and abaft the masts for wedging against; they let into a double rabbet taken out of the mast carlings, and are bolted through these, with two or three bolts in the end of each piece.

Midships (see Amidships).

Midship Bend or Frame (Swedish, *nollspant*; Danish, *middel-spant*; Dutch, *hoofd-spant, middel-spant*; German, *haupt-span, mittel-spann, lehr-spann*; French, *maître couple*; Italian, *quaderno maestro*; Spanish, *cuaderna maestra*; Portuguese, *baliza ou casa mestra*) called dead flat (see Flats).

Miter or Mitre, the mode of joining two solid pieces, by bringing together two sections by which they are cut oblique, or that, when together, the joint may form an angle equal to both.

Mortise or Mortoise, a hole of a certain depth, cut in any piece of timber, to receive the end, or what is called the tenon of another piece.

Mould (Swedish, *mall*; Danish, *skabelon*; Dutch, *mal*; German, *mall*; French, *gabarit*; Italian, *garbo, festo*; Spanish, *galibo, grua de tablas, plantilla*; Portuguese, *forma*) a piece of thin deal or board made to any intended shape for giving the form of a timber.

Moulded, formed to the mould: also the dimensions, size, or scantling of any timber. The way in which it is formed by the mould, as the in-and-out dimensions of the timbers of the frame (65), is the moulding, while the breadth is called the siding. In the same manner, the up-and-down dimensions of the beam are called the mouldings, because they are formed by the mould that way, while their breadth is likewise called the siding.

Mouldings, parts that project for ornament, as the rails of the stern and head, or the mouldings worked on the angles of different timbers and brought on the face, or worked in the pannels of bulkheads. They are flat, round, hollow, or inflected; and consist of the fillet, list or annulet, the astragal or bead, the cyma reversa or ogee, the cyma recta, the cavetto or hollow, the ovolo or quarter-round, the scotia, and the torus. The rail are formed by an assemblage of these mouldings, with straight and curved ones alternately, applied, as to disposition and proportion, to produce the best effect. On the angles of different timbers, they are in general worked singly, and mostly the ovolo or quarter-round; and on the bulkheads, to give relief, and in the pannels, the ogee, ovolo, and astragal are generally used.

Moulding (Swedish, *bemalla*; Danish, *bemalle*; Dutch, *bemallen*; German, *bemallen, ein stück holz*; French, *gabarier une pièce*; Italian, *modellare, festare*; Spanish, *galibar*; Portuguese, *galivar*) forming any timber by a mould.

Munions or Muntons, are short pieces placed up-and-down to divide the pannels in framed bulkheads, to give them the proper proportions; and to divide the lights in the stern and quarter galleries.

Nails (Swedish, *spik*; Danish, *spiger*; Dutch,

spykers; German, *spiker*; French, *clous*; Italian, *chiodi*; Spanish, *clavos*; Portuguese, *cravas*) pins of iron used for fastening plank, board, iron work, &c. They are of various descriptions, according to the purposes they are for; as the *Deck Nails*, which are double and single. Double deck nails are from 6 to 12 inches, and single from 4 to 5 inches in length; they have a small head, and are used for fastening planks and the flat of the decks. *Weight Nails* are similar to deck nails, but have a square and larger head; they are used for purposes where it is not necessary to have their heads driven within the wood, as any temporary fastening, as the cleats over the heads of shores, &c. *Ribband Nails*; these nails have large round heads, that they may be easily drawn, and have round points; they are used for fastening the ribbands, &c. *Nails of Sorts* are called 2, 3, 4, 6, 10, 20, 24, 30, and 40 penny nails, all of different lengths, the 40 penny being next below the single deck; they are used for nailing thin plank, board, &c. *Clamp Nails* are a short stout nail, with large heads, used for fastening iron clamps, &c. *Port Nails* are similar to clamp nails, but are double and single; they are used for fastening iron work. *Rudder Nails* are likewise similar; they are used principally for fastening the pintles and braces. *Sheathing Nails*, when used, are for fastening the sheathing on the bottom. *Filling Nails* were a cast iron nail driven into the sheathing, very thick, when copper sheathing was not used. *Lead Nails* are round-headed and small nails for fastening lead. *Scupper Nails* are short broad-headed nails, used for nailing the leather flaps over the scuppers, &c. *Flat Heads* or flat nails, are small nails sharp pointed with flat heads, for nailing lead, and paper under the copper, &c. *Boat Nails* are nails of various sorts, both of copper and iron, used in building boats: they are in general rose-headed and square at the point.

Navel Hoods (see Bolsters of Hawse).

Necking (see Cove).

Nog, a short treenail that projects, to keep any timber in its place (16) to place shores against, or that is driven in to fasten the heels of shores, &c.

Nut (see Anchor).

OAK (Swedish, *ek;* Danish, *leg;* Dutch, *eike;* Germ. *eiche;* Fr. *chêne;* Ital. *quercia;* Spanish, *roble;* Port. *carvalho)* a timber from which ships are principally built. There are various sorts used in ship building. The most common species used for building British ships are the English, Dantzic or North Country, American, and of late Adriatic Oak. The *English Oak* is the *quercus fœmina* and *quercus robur;* the former is considered the best, and grows principally in Sussex and Kent. The latter, which is called the common English oak, grows in most parts of the kingdom and in Wales, in woods, forests, and in hedge-rows; this timber is used for all the principal parts of the structure, and for planking as low as the light water line. The *Dantzic* or *North Country Oak,* which is cut in Poland, is used for the flat of decks, where oak is used, and for the bottom below the light water line. The *American Oak* is of two sorts, the *quercus rubra,* and *quercus alba,* or the Canada red and white. This timber is the most inferior to any of those from the other countries; it is used for some of the purposes for which the Dantzic oak is used. The *Adriatic Oak* is considered preferable to any of the foreign oak, and is employed for many purposes where the British oak is used.

OAKHAM or OAKUM (Swedish, *dref;* Dan. *værk;* Dutch, *werk;* German, *werg oder werk;* French, *étoupe;* Italian, *stoppa;* Spanish, *estopa;* Portuguese, *estopa)* a substance reduced from old ropes when untwisted; it is called black or white oakum, according as it is formed from tarred or untarred ropes, and sometimes of flax.

OARS (Swedish, *ăra;* Danish, *aare;* Dutch, *riem;* German, *riem;* French, *rame, aviron;* Italian, *remo;* Spanish, *remo;* Portuguese, *remo)* instruments used for impelling boats, &c.

ORLOP (see DECK).

OUTBOARD, on the outside of the ship.

PALLETTING, a platform formed formerly at a small distance above the magazine, flat, to keep the powder from getting damp. Beams were laid about two feet apart across the magazine, called palletting beams, and between them carlings at the same distance apart, called palletting carlings; these beams were nailed to the flat, and had a

rabbet taken out of their upper edges, to receive scuttles, which were called palletting scuttles.

PAUL or PALLS (see CAPSTAN).

PAUL BITTS (see BITTS).

PANEL (see BULKHEADS).

PARTNERS OF THE MAST (see MAST).

PARTNERS OF THE CAPSTAN (see CAPSTAN).

PAUNCH (351).

PILASTERS, a square flat pillar placed against thick stiles or munions of bulkheads, and sometimes on the munions of the stern and quarters, for ornament; they seldom, in naval architecture, project more than from $\frac{3}{4}$ of an inch to an inch and $\frac{1}{2}$, as to project more would expose them to be knocked off. They in general have their faces reeded or fluted, and have moulded caps and bases (see BULKHEADS).

PILLARS (Swedish, *dack-stöttar;* Danish, *dæk-stötter;* Dutch, *dek-stutten;* German, *deck-stutzen;* Fr. *épontilles;* Italian, *pontali delle coperte;* Spanish, *puntales de läs cubiertas;* Portug. *pontaletes das cubertas)* pieces of timber erected vertically under the middle of the beams, for supporting the decks; their ends tenon into the beams above, and into the flat of the deck or keelson below; above the lower deck they are in general turned, but those on the orlop and in the hold have only a champher taken off their angles.

PINK (Swedish, *pink eller pinque;* Danish, *pink;* Dutch, *pink;* German, *pinke;* French, *pinque;* Italian, *pinco;* Spanish, *londro, pinque;* Portuguese, *pinque)* a vessel navigated in the Mediterranean, with two masts and two lateen sails, and a very small mizen. Likewise a ship with a very narrow stern; whence all vessels with sterns fashioned in like manner are called pink-sterned.

PINNACE (Swedish, *pinnasse;* Danish, *pinnasse;* Dutch, *pinas;* German, *pinasse oder pinnasse;* French, *le second canot d'un vaisseau de guerre, sorte de chaloupe mâtée en goëlette;* Italian, *la segunda lancella d'un bastimento di guerra, sorte di goeletta;* Spanish, *el segundo bote de un navio de guerra, sorte de goeleta;* Portuguese, *pinaca)* (see BOATS.)

PINTLES (Swedish, *roder-hakar;* Danish, *roer-hager;* Dutch, *roer-haaken;* German, *ruder haken;* Fr.

éguillots du gouvernail; Italian, *maschj del timone;* Spanish, *machos del timon;* Portuguese, *machos do leme)* (see GOOGINGS).

PLANKS (Swedish, *plankor:* Danish, *planker;* Dutch, *planken;* German, *planken;* French, *bordages;* Italian, *bordaggi;* Spanish, *tablas;* Portuguese, *pranchas, taboas)* all timber from 1 inch and ½ to four inches in thickness has this name given it, except fir, which frequently, to three inches in thickness, is called deal.

PLANKING (95).

PLANKSHEER (see GUNWALE).

POOP OR ROUNDHOUSE (see DECK).

POLACRE (Swedish, *polacker;* Danish, *polakker;* Dutch, *polaka, polaak;* German, *polacker;* French, *polacre;* Italian, *polacra;* Spanish, *polacra;* Portuguese, *polacra)* a ship navigated in the Levant and other parts of the Mediterranean. They have three masts commonly formed with the standing mast, topmast, and topgallant mast in one, and in general carry square sails upon the main, and lateen upon the fore and mizen masts; though some polacres carry square sails on all three masts. The topgallant and topsail yards lower down, so as to furl and reef on the yards below, as they have no horses upon them.

POOP, or Roundhouse (see DECK).

POPPETS (see LAUNCH).

PORT, a name given to the larboard side (see LARBOARD).

PORT (Swedish, *portar;* Danish, *kanon-porter;* Dutch, *poorten;* German, *pforten, stuck-pforten, pfortgaten;* French, *sabords;* Ital. *portelli;* Spanish, *portas;* Portuguese, *portas)* the holes or embrasures in the sides of ships of war, for pointing the guns on the different decks or batteries through. The ports are formed on the sides by the timbers of the frame (NOTE 28), and on the upper and lower parts by pieces lying after the sheer, called port sills (fig. 13); they are distinguished by the upper (*m*) and lower (*n*) port sills; the upper is tailed into the timber, and lower billed.

PORT HOOKS, iron hooks for fixing the port hinge upon, and upon which the port-lid revolves. One arm

of the hook is driven through the side, at a proper height above the port, and is clenched on the inside.

Port Lids, lids or shutters fixed to the middle and gun deck of ships of the line. They are made of fir in two thicknesses; the inner thickness is called the lining, and is placed with the range of fibre up-and-down, and of about two inches in thickness, with its inner part bedding or faying close to the back stops. The outer thickness, called the outside stuff, lies fore and aft, so as to cross the lining, and is of a substance sufficient to be well with the outer part of the outside planking, at the thinnest part. The lining is fastened to the outside stuff by nails about 2½ inches apart. These lids are hung with two hinges, which have in their lower end one shackle on each outside for the port ropes, and one in each inside for the port fastening. These shackles in general forelock. The hinges are fastened, in addition to the shackles, which form part of the fastening, with one saucer-headed bolt, as close up to the upper part as to be just below the upper stop, which is driven on the inside and forelocked on the out; and one or two saucer-headed bolts in each breadth of outside stuff is driven from the outside, and clenched upon the lining. In the port lid is cut a scuttle, to be opened for air, wnen the lid is shut in, and one illuminator is fixed in it to give light when the badness of the weather compels the scuttle to be shut in. The port lids are made to fit very close to the back stops, but to come out and shut in easy. After the ports are eased in, which is not done, for the last time, till all the guns and stores are on board, the back stops are lined over with fearnought or kersey; and likewise the back stops of the scuttle.

Port Sills (Swedish, *portrympel*, *tröskel*; Dan. *bossebænken*; Dutch, *drumpel*; German, *drempel*; Fr. *seuillets*; Italian, *mezzanili*; Spanish, *batiportes*; Portuguese, *batentes)* (see Port).

Port Stops (see Note 44).

Post, Sternpost (Swedish, *ackterstäf*; Danish, *agterstævn*; Dutch, *steven*, *agter-steven*; German, *steven*, *hintersteven*; French, *étambot*; Italian, *asta di poppa*; Spanish, *codaste*; Portuguese, *cadaste)* (36 and 37).

Samsons-Post (Swedish, *stöttar med klampar*;

Danish, *stötter under storlugens bielker med klamper*; Dutch, *stutten met klampen om af, of op te klimmen*; German, *deck-stutzen mit lippen*; French, *étances à manche*; Italian, *pontali della stiva con tachj*; Spanish, *pies de carnero*; Port. *pés de carneiro)* a post or stanchion extending from one deck to the other, fixed against the side of the beam of the deck above, and tenoned into the flat of the deck below, for bringing a strap or leading block to, when hoisting in the boats, &c. It has a notch formed in the middle, for the strops of the block, and a strong cleat on each side of its head, nailed to the beam above, to prevent its coming out of its place when in use.

PREVENTER BOLTS (see CHAIN BOLTS)

PREVENTER PLATES (see CHAIN BOLTS).

PROFILE (see DRAUGHT).

PUMP (Swedish, *pump*; Danish, *pompe*; Dutch, *pomp*; German, *pumpe*; French, *pompe*; Italian, *tromba*; Spanish, *bomba*; Portuguese, *bomba)* a machine used for discharging water from the hold of the ship into the sea. Pumps used generally on board of ships are of two sorts, called the hand pump (Swedish, *stekpump*; Danish, *steeg-pompe*; Dutch, *steek-pomp*; German, *steek-pump*; French, *pompe à bâton, pompe à main*; Italian, *tromba da mano*; Spanish, *sacabuche*; Portuguese, *bomba de maom*) and chain pump (Swedish, *stormpump, kiettingspump*; Danish, *stormpompe, kiedepompe*; Dutch, *ketting-pomp*; German, *ketten-pumpe*; French, *pompe à chapelet*; Italian, *tromba a catene*; Spanish, *bomba de cadena, ó de rosario*; Port. *bomba de roda*). The *Hand Pump* is formed by a wooden tube, that extends from the limbers (or from a cistern in the well, if for washing decks) to the deck upon which it is to be worked, with a part in the bore, or hollow of the tube, to a certain distance down, called the chamber, at the lower part of which is fixed a piston called the lower box; and placed at the upper part is an iron stanchion, fixed to the pump by means of a hoop and a staple, that it may be unfixed, for forming the fulcrum for the handle or brake; and to the end of the brake is attached an iron rod called the spear, with a piston fixed to its lower end, called the upper box. The brake, which is fixed by a bolt between two cheeks in the stanchions, is made to act

as a lever on the spear, to produce the motion on the upper box. At the lower end of the pump or tube in the limbers is fixed what is called a basket, to prevent any thing that may stop the action of the valves in the boxes, from ascending. These pumps are used principally in small vessels, and only for secondary purposes in the larger class of ships. The *Chain Pumps* are formed by a mixed metal chamber at the lower part, let sufficiently down into the timbers, below the limbers, for the water to drain to its lower part, having a tube connected with it for the water to be conveyed up by means of a chain, that passes over a wheel, called the sprocket wheel, fixed on the gun and upper or middle deck, according to the place where they are to be worked, formed of a number of similar links, that in the event of one being broken it may be readily replaced, connected together at their joints by pins, and having fixed to every sixth link a saucer for bringing the water up, called the saucer link. This chain has no end; the links are connected all round, and made to pass over the wheel and through the chamber below, bringing up on one side, as the wheel turns, a column of water with it, and returning on the other through a trunk, called the back casing. The tube and back casing is fixed, and the circumference of the wheel over them, so that the saucers pass up one and down the other without striking. The wheel has an axle connected with it, upon which winches are fixed for turning it. The winches in general revolve on rhodens attached to the topsail sheet and jeer bitts, and to the pillars, or else in cranks suspended to the beams for the purpose; and the axle works on rhodens fixed to the cistern, which receive the water as it is thrown up. The cisterns are two on each side; they are made of oak plank, the bottom and ends 4 inches and the sides 3 inches in thickness; the bottom and ends have a double rabbet taken out of them, to receive the sides, and have two or three strengthening bolts driven through them. These cisterns are caulked, and are fixed over what is called the poppets, or short pieces of the tube and back casing, to continue them above the deck; they are let down into the mast carling or partners, and are hooped. As the pump dale is only fixed to one cistern on each side, conductors

are attached to the cisterns, that the water may have a free communication with the whole of them.

Quarter Deck (see Deck).

Quarter Galleries (see Galleries).

Quarter Pieces, pieces that form the boundary of the stern on each side and the after part of the quarter gallery.

Quarter Rails (see Galleries).

Quick Work (162).

Rabbet (Swedish, *spunning;* Danish, *spunning;* Dutch, *sponning;* German, *sponning;* French, *rablure;* Italian, *battidura, appuntadore;* Spanish, *alefris;* Portuguese, *alefris)* a groove or channel cut longitudinally in any timber, or in the edge of any plank or board, to form into a similar channel or groove in any other piece, or for receiving the edge of any plank, as the rabbet of the keel (22), to receive the edge of the garboard strake, or the ends of any planks, as the rabbet of the stem (24) and stern post (39), to receive the hooding ends.

Rag Bolt (see Bolt).

Rails, strips of timber brought on different parts of the ship, to form a protection; as the *Roughtree Rails* (Swedish, *finkenäts-relingar;* Danish, *reilinger, reilings-lister;* Dutch, *regelinger van het vinkenet;* German, *regelingen des finkenetzes;* Fr. *lisses de bastingage, lisses de batayoles;* Italian, *battagliuola;* Spanish, *batayola;* Portuguese, *corrimaom das trincheiras)*, which are mortised on the heads of the rough-tree timbers (see Timber Heads), on the roundhouse, or forecastle in small vessels; *Breast Rails*, which form the rails of the breast-work (see Breast-work) and fife-rails (110 and 120); or rails for ornament, as the *Waist Rail* (Swedish, *răhult;* Danish, *raaholt;* Dutch, *haahout;* German, *raaholz, raaleiste;* French, *lisse de vibord;* Italian, *cao da banda;* Spanish, *galon da borda;* Portuguese, *verdugo da borda)* a rail formerly that extended the length of the ship on the topside, and was placed, in amidships, about half way up the upper deck ports, and carried parallel to the sheer; *Sheer Rail*, a rail formerly extending the length of the ship, in a line with the channels; *Drift Rails*, rails placed on the topside, parallel to the sheer, and formed with the

drifts; and *Rails of Head*, *Stern*, and *Quarter* (see HEAD, STERN, and QUARTER, for their different names).

RAKE, to incline, as what the stem is inclined forward from a vertical line, or a line perpendicular to the keel, it is said to rake more or less; or according as the stern post and counter timber or stern are inclined aft, they are said to rake aft.

RANGES (see CLEATS).

RATE, the denomination of the different class of ships, or the order into which ships of war are divided, according to their force. The rates of ships formerly were, those of 100 guns and upwards, *first rates;* those of 98 and 90 guns, *second rates;* 80, 74, and 64 guns, *third rates;* 60 and 50 guns, *fourth rates;* 40, 38, 36, and 32 guns, *fifth rates*; and all under, *sixth rates.* Fire ships and hospital ships were rated as fifth rates. Now ships of 120, 112, 110, 108, 106, and 104 guns are rated as *first rates;* of 84, 82, and 80 guns, *second rates;* 78, 76, and 74 guns, *third rates;* 60, 58, and 50 guns, *fourth rates;* 48, 46, 44, and 42 guns, *fifth rates;* and ships of 34, 32, 28, 26, and 24 guns, as *sixth rates.*

RENDS, are large splits or shakes in timber or plank, most common to planks.

REPAIRS are the replacing any defective part, or the operation of amending injuries sustained in tempestuous weather, in battle, by taking the ground, or by any other means. Repairs are considered under two general classes, *Casual* and *Thorough.* Casual, when visible damages and defects are made good; thorough, when all defects are searched for, and such parts removed as may prevent the discovery of defects, and the whole replaced. This repair is divided into several classes, according to the state of the ship.

RHODENS or RHODINGS, a kind of brass cleats used as the bearings, for the axles and winches of the chain pumps to work in (see PUMPS); also fixed in the steering wheel stanchions, for the axle of the steering wheel, &c.

RIBBANDS (Swedish, *sentor;* Danish, *sænter;* Dutch, *centen of senten;* German, *senten;* French, *lisses;* Italian, *forme, maestre;* Spanish, *maestras, vagaras;* Portuguese, *armadouras)* (74).

Riders (Swedish, *kattspär;* Danish, *katspor;* Dutch, *kattespooren;* German, *katspuhren, katsporen;* French, *porques;* Italian, *porche;* Spanish, *bularcamas;* Portuguese, *prodigos do poraom).* Those in the hold were called *Floor* (Swedish, *katsporets, bätnstäckar;* Danish, *katsporets, bundstokker;* Dutch, *buikstukken van de kattespooren;* German, *bauchstucke der katspuhren;* French, *varangues de porques;* Italian, *matere delle porche;* Spanish, *planes de las bularcamas;* Portuguese, *cavernas dos prodigas do poraom)* and *Futtock Riders* (Swedish, *katsporrets uplangor;* Danish, *katsporenes oplanger;* Dutch, *de oplanger van de kätspooren stuinders;* German, *auflanger der katspuhren;* French, *allonges de porques*; Italian, *stamenali delle porche*; Ven. *forcameli dei raisoni;* Spanish, *jenoles de las bularcamas;* Portuguese, *bracos dos prodigos do poraom):* and those above *Breadth* and *Top Riders* (263 to 270).

Rim Rails or Rims (see Qarters).

Ring Bolts (see Bolts).

Rings, circles of iron, copper, or mixed metal, upon which the points of bolts are clenched or rivetted. Also rings that pass round the mast hole, for fixing the mast coat to, &c.

Rising Floor (see Floor).

Rising Wood or Dead Wood (see Dead Wood).

Rollers (Swedish, *rullar*; Danish, *ruller*; Dutch, *rollen*; German, *rollen*; French, *rouleaux*; Italian, *rotoli*; Spanish, *polines*; Portuguese, *rolos)* cylindrical pieces of oak, or some hard wood, with a hoop at each extremity, and with pins or what is called sprigs, to form an axle for them to revolve on, driven into each end. These rollers are fixed wherever any hawser, &c. is worked, or where it would chafe hard against any part of the ship, in transporting, unmooring, &c. as against the jeer and topsail sheet bitts. Those for the use of the voyal or messenger are called messenger rolls; two or more vertical and one or more horizontal are placed close forward on the hawse hook, when there is one, for passing the bight of the messenger when heaving the cable in.

Room and Space (see Note 29).

Rough-tree Rails (see Rails).

Round House (see Deck); likewise places of convenience formerly fixed for the officers at the fore part of the beakhead bulkhead.

Round-aft, the segment of a circle, of which the stern is formed above the wing transom.

Round Stern (see Note 33).

Round-up, the segment of a circle of which the upper surfaces of the deck, filling, and wing transoms; beams, transoms and hooks to the different decks, and the upper part of the different rails of the stern, are formed.

Row Ports (Swedish, *ro-portar*; Danish, *roe-porter*; Dutch, *roey-poorten*; German, *roje pforten*; French, *sabords des avirons*; Italian, *portelli dei remi*; Spanish, *portas de los remos*; Portuguese, *portas dos remos)* large scuttles in small vessels through the side, between the gun ports, to work the sweeps for impelling them in calm and light winds.

Rowlocks (Swedish, *ăr-klampar*; Danish, *klamper paa tollegangen*, *aar klamper*; Dutch, *roejklampen*, *velden*; German, *roje-klampen*; French, *taquets de nage*, *dames*, *tolletières*; Italian, *scarmi al modo di norte*; Spanish, *toletes al modo de norte*, *tojinos de remos*; Portuguese, *toleteras)* the spaces between pieces fixed in the gunwale of boats, called tholes, which are for forming the fulcrum for the oars when rowing, and to prevent them sliding forward.

Rudder (see Helm).

Rudder or Rother (Fig 9) a machine attached to the stern post by pintles and braces (googings), for steering, or directing the course of the ship. It is formed of several pieces coaked and bolted together; the principal piece is called the main piece *(a)*, and forms the head; it is of oak. The other pieces make up the breadth at the lower part. Those on the aft side are in general of fir, and those on the fore side of elm; a plank is frequently brought on the aft side called the back, *(o)* and a piece on the lower end, called the sole. The fore edge of the rudder is formed to an angle at the middle line, called the bearding, to allow the rudder to go sufficiently over. Formerly the whole of the bearding was taken off the rudder, but now it is taken equally off the rudder and stern post.

Rudder Chocks, chocks made to fill up on each side the rudder in the rudder hole, to keep the rudder from motion while a tiller is refixing, in the event of its being carried away, &c. They are made of fir, with a projection at the upper part, to keep them up, and a ring bolt driven through them, for the convenience of getting them in and out of their places.

Rudder Irons, a name sometimes given to the pintles.

Run (Swedish, *piken*; Danish, *piggen*; Dutch, *piek*; German, *piek*; French, *les ailes, extremités de la cale vers les façons de l'arrière*; Italian, *pajolo nel taglio di poppa*; Spanish, *pannol de los delgados de popa*; Port. *paiol do delgado arré)* the narrowing of the after part of the ship; thus a ship is said to have a full or clean run.

Rung or Wrung Head, a name sometimes given to the upper ends of the floor timbers (see Floor Head).

Saddle, a piece, formerly, sometimes brought on the upper part of the lacing of the figure, for securing the fore end of the main head rails.

Saddle for the Jib Boom (378).

Sagging, a bending down; an effect produced on the structure contrary to hogging (Note 2), and mostly takes place in the neighbourhood of the main mast; to prevent which an additional keelson has lately been introduced on each side, under the step of the mast.

Sampson's Post (see Post).

Sap of Timber (Swedish, *spint*; Danish, *spint, gejte*; Dutch, *spind of spint*; German, *spint*; French, *aubour, aubier*; Italian, *alburno*; Spanish, *albono*; Portuguese, *alvura interior da madeira)* sap-wood or alburnum, the outer and softest part of the wood, or intermediate portion of the caudex, which is always removed, except from elm, before the timber is employed in the ship.

Scantling, the dimensions that are given for the different timbers, planks, &c.

Scarphing, the uniting of two pieces together, by lapping one piece on the other, and letting them in at the thin ends or lips, so as to bring them almost to appear as one solid, and with even surfaces.

Scarphs (Swedish, *lask eller skarf*; Danish, *lask*;

Dutch, *lasch*; German, *scherbe*; French, *écart*; Italian, *giunta, paella*; Spanish, *junta, escarba, escarpe*; Portuguese, *escarba).* Scarphs are called side, when their surfaces are parallel to the sides, as the scarphs of the keel (18) and beams (188), and flat, when their surfaces are opposite, as the scarphs of stem (26), dead wood (52), and keelson (89). They are called coak scarphs when they have coaks in them, hook and butt scarphs, when they are formed with a hook or projection, for one part to form into the other, as the scarphs or the string (153) and clamps (149), and key scarphs, when their lips are made to form tail, and are set close by wedge-like keys at the hook.

SCHOONER (Swedish, *scooner*; Danish, *skooner*; Dutch, *schoener*; German, *schuner oder schooner*; Fren. *goëlette*; Italian, *goletta, scuna*; Spanish, *goeleta*; Portuguese, *scuna)* vessels with two or three masts, with fore and aft sails, suspended from gaffs.

SCREEN BULKHEAD (see GALLERY).

SCUPPERS (Swedish, *spygattor*; Danish, *spyegatter*; Dutch, *spy-gaten*; French, *dalots*; Italian, *brunali, imbrunali*; Spanish, *embornales*; Portuguese, *embornaes)* holes cut through the side, with leaden pipes in them, for conveying the wate from the different decks into the sea.

SCUTTLES, openings through the deck, in general for passing different articles from deck to deck (see HATCHES); likewise holes through the side into the officers' cabins, and through the port lids, for the admission of air and light.

SEAMS (Swedish, *nătar*; Danish, *naader*; Dutch, *naaden*; German, *nathen*; French, *coutures*; Italian, *incomenti*; Spanish, *costuras*; Portuguese, *costuras)*, the space between the edges of the different planks when worked (see CAULKING).

SEAT OR SEATING, a surface trimmed out for a chock or any timber to fay to; likewise the part of the floor which fays on the dead wood, and the transom which fays to the stern or inner post.

SEAT TRANSOM, a transom fayed and bolted to the counter timbers, above the deck, in general at the height of the port sills.

SHACKLES, small ring bolts fixed in the port lids and scuttles, for fixing them in, &c.

Shaken, or Shakey, a defect in timber and plank, when it is full of splits or clefts. It is said to be quaggy, and is produced in general while growing, by lightnings, powerful winds and frosts. They are commonly called cup shakes when the concentric, and heart shakes, when the divergent layers are separated.

Shallop, a large boat with two masts, generally rigged as a schooner.

Shank (see Anchor).

Shank Painter (Swedish, *rustlina*; Danish, *röstlinie*; Dutch, *rust-lyn*, *russeling*; German, *rustlien*; French, *serre-bosse*; Italian, *serra-boza delle patte*; Spanish, *boza de la unna*; Portuguese, *boca das unhas)* a chain fixed at one end by a spanshackle, or bolted to the top-side, for hanging the shank and fluke of the anchor, while the ring and stock is hung up by the stopper to the cat-head.

Sheathing (Swedish, *förhudning*; Danish, *forhudning*; Dutch, *verdubbeling*; German, *spiker-haupt*; French, *doublage*; Italian, *dobblaggio*, *buonbordo*; Spanish, *embon*, *forro*; Portuguese, *forro)* a thin doubling of fir board, formerly brought on the bottoms of ships, to protect the plank from worms, &c., between which and the bottom was inserted tar and hair, and sometimes brown paper dipt in tar and oil. Now the bottom is covered with copper sheathing of 18, 28, and 32 oz. to the foot square. Mostly on large ships 32 oz. is used at the water line and bows, and the 28 oz. in the other parts; 18 oz. is used on the bottom of small vessels. It is laid on in sheets 28 and 32 oz. of 14 inches by 4 feet. and 18 oz. of 20 inches by 4 feet. The sheets are placed for the after end of one sheet to lap over the fore end of the other, and the upper edge to lap over the lower.

Shive or Sheave (Swed. *skifua*; Danish, *skiven*; Dutch, *schyf*; German, *scheibe*; French, *le rouet*; Italian, *poleggia*; Spanish, *roldana*; Portuguese, *roldana ou roda)* a pulley or small wheel that revolves upon an iron pin for its axis, in a channel or groove of a block, or in channels cut in different parts of the ship, as in the fixed blocks, catheads, &c.

Shive-Hole (Swedish, *skifgattet*; Danish, *skiv-*

gattet; Dutch, *schyfgat*; German, *scheibengat*; French, *mortaise, clan*; Italian, *occhio d'un bozzello*; Spanish, *mortaja, cajera*; Portuguese, *o gorne*) a mortise or channel for the shive to work in.

SHEER (Swedish, *skabnaden of et skepp*; Danish, *skibets skabning*; Dutch, *strooking, strook*; German, *stroking oder strook des schiffs*; French, *fabrique d'un vaisseau*; Italian, *l'arcato*; Spanish, *trazo*; Portuguese, *tozamento* (103, 104, and 105.)

SHEER DRAUGHT (see DRAUGHT).

SHEER RAILS (see RAILS.)

SHEER STRAKES (120, 121, and 122).

SHEER WALES (118).

SHIFT, to shift the disposing, or placing different timbers and planks in relation to each other, so as for them, by their combination, to give the most strength, as the shift of the different planking (172, 173, 174) shift of deadwood (54) and apron (28), &c.

SHIP (Swed. *skepp*; Danish, *skib*; Dutch, *schip*; German, *schiff*; French, *vaisseau*; Italian, *vascello*; Spanish, *navio*; Portuguese, *navio*) a general name given to all vessels, but particularly applied to those equipped with three masts, having lower masts, topmasts, and topgallant masts. Ships of war are distinguished from each other by their classes and force (see RATES).

SHOLES (271).

SHORES (Swedish, *stöttar*; Danish, *stötter*; Dutch, *stutten, schooren*; Germ. *stutzen*; Fr. *acores, épontilles*; Italian, *pontali*; Spanish, *escoras, puntales*; Portuguese, *esbirros, escoras*). (NOTE 32).

SHOT LOCKERS (see GARLANDS).

SIDE COUNTER TIMBER (79).

SIDED is the size or dimensions of any timber from side to side, or the breadth. It is a dimension given the contrary way to the moulding (see MOULDING).

SILLS (see PORT).

SKEG, the after end of the keel, or that part upon which the stern-post steps.

SKEG SHORES, shores placed under the after end of the keel, for steadying the after part of the ship, while supported by the cradle, before she descends. They are

placed perpendicular to the ways, and are in general made of 4-inch plank, with the upper end rounded.

SLEEPERS, timbers inside for giving strength to the buttocks, and for combining the stern frame to the frame (65). Their after ends lie upon the transoms, through which they are bolted with two bolts in each; and they extend to some distance forward, so as to bolt through several of the adjoining timbers of the frame.

SLICES, pieces about 12 inches wide, and from 2 to three feet in length, according to the purpose they are for, formed like wedges of small angles (see LAUNCH).

SLIDING PLANKS (see LAUNCH).

SLIP (14).

SLOOP (Swedish, *enmastad fartyg*; Danish, *eenmastig fartöj*; Dutch, *eenmastig vaartuig*, *een vaartuig met eene mast*; German, *einmastiges fahrzeug*; French, *bâtiment à un mât*; Italian, *bastimento che ha un solo albero*; Spanish, *balandra*; Portuguese, *chalupa)* a vessel with one mast, with the principal sail, which is abaft the mast, attached to a gaff, called the main sail, and two sails before, called the foresail and jib; they have likewise sometimes sails attached to the yards, called the square sail and square topsail.

SNAPE, to bevel off the end of any timber, so that it may fay to an inclined surface, or be inclined to any surface.

SNOW (Swed. *snau*; Danish, *snau*; Dutch, *snauw*; German, *schnau*; French, *sénau*; Italian, *checia*, *senau*; Spanish, *paquebote*; Portuguese, *paquebote*, *senau)* a large brig with a main trysail mast.

SNYING (99).

SOLE (see RUDDER and BUILGEWAYS).

SPALING, keeping the frames (65) of the ship to their proper breadth (see CROSS-SPALLS).

SPANSHACKLE, a bolt with a swivel, such as the bolt used, in general, for securing the shank painter to the side, &c.

SPARS (Swedish, *spirar eller bommar*; Danish, *spirer*; Dutch, *spieren*; German, *spieren oder sparren*; French, *espars*; Italian, *percie*, *bastoni*; Spanish, *perchas*, *bordones*; Portuguese, *perchas*, *vergontas)*. Spars or

sticks from six hands downwards, are distinguished into cant, barling, boom, middling, and small. *Cant* spars are from 5 to 6 hands, at 3 feet 4 inches from the butt; *Barling* from 4 to 5, at 2 feet 8 inches; *Boom* from 3 to 4, at 2 feet; *Middling* from 2 to 3, at 2 feet; and *Small*, from 1 to 2 hands in circumference, at 2 feet from the butt. These spars are in length, cant from 33 to 35 feet, barling from 28 to 30, boom from 20 to 24, middling from 16 to 20, and small from 11 to 16 feet; whereas sticks not hewn, but in their round state, from 6 to 25 hands in circumference, are called hand masts; they are from 36 to 93 feet in length; but sticks that are hewn are called inch masts, yards, &c.

Spiles (Swedish, *spik-pinnar*; Danish, *spiger-plygger eller spiger-pinder*; Dutch, *spyker-pinnen*; French, *épites*; Italian, *spiccie*; Spanish, *espiches*; Portuguese, *bujoes)* wooden pins which are driven into nail holes to prevent their leaking. Those for bolts, and formed cylindrical or somewhat conical, are called plugs.

Spindle (see Capstan).

Spindle of a Mast (328).

Spirketting (Swedish, *sättvägare*; Danish, *sætgangen*; Dutch, *set weeger*; German, *setzweger*; French, *feuilles bretonnes*; Italian, *serrette fulli trincanili*; Spanish, *cerretos ó varengas sobre los trancaniles*; Portuguese, *cusseiras* (159, 160, and 161).

Spla Boards, boards fixed obliquely to allow the light to diverge, as those fixed formerly to the magazine lights; or to break the sea off, as those fixed under the hammock board in the waist, &c.

Sprigs (Swedish, *dykar*; Danish, *dyker*; Dutch, *duikers*; German, *dukers*; French, *petits clous sans tête*; Italian, *piccoli chiodi senza testa*; Spanish, *clavos sin cabeza*; Portuguese, *pequenos cravos sem cabeca)* an iron pin cylindrical at one end, and sharp-pointed and in general jagged at the other, as those driven into the ends of rollers, &c. (see Rollers).

Sprung, a term signifying that a mast (460) or any timber has been over strained, consequently has a disruption, or has some of its fibre broken off. To spring is likewise to raise or quicken the sheer.

SPURN WATER or SPUN WATER, a hollow chan-left above at the ends of a deck, to turn the course of the water to the side of the ship, or to prevent its flowing over.

SQUARE FRAMES (67).

STANDARDS (see KNEES).

STANCHIONS or STANTIONS, the upright pieces attached to different bulkheads, for forming and securing them. There are likewise iron stanchions, (Swedish, *sceptor*; Danish, *scepter*; Dutch, *scepters*; German, *zepter*; French, *chandelières de fer*; Italian, *candelieri di ferro*; Span. *candeleros*; Portuguese, *balaustes de ferro*) placed in different parts for fixing rails in, &c. (see HAMMOCK STANCHIONS).

STAPLES (Swedish, *krampa*; Danish, *krampe*; Dutch, *kram*; German, *krampe*; French, *crampe*; Italian, *crampa*; Spanish, *crampon*; Portuguese, *tisoura*) a bent fastening of metal, formed as a loop, and driven in at both ends, for securing two pieces; as the keel staples, which are of copper, for securing the false to the main keel. These staples have the two parts that are driven in, jagged.

STARBOARD (Swedish, *styrbord*; Danish, *styrbord*; Dutch, *stuurboord*; German, *steuerbord oder sturbord*; French, *tribord*; Italian, *bordo a dritta*; Spanish, *estribor*; Portuguese, *estibord*). The side of the ship that is on the right hand when looking forward, is called the starboard side.

STEELER (100).

STEERING WHEEL (Swedish, *drill*; Danish, *rattet*; Dutch, *stuur-rad*; German, *steurrad*; French, *roue de gouvernail*; Italian, *routa del timone*; Spanish, *rueda de timon*; Portuguese, *roda do leme*) (see WHEEL).

STEM (Swedish, *forstäf*; Danish, *forstævn*; Dutch, *steven, voor-steven*; German, *steven vorsteven*; French, *étrave*; Italian, *astella, asta di proa*; Spanish, *branque*; Portuguese, *roda de proa*) (23, 24, 25, 26, and 27).

STEMSON (92).

STEPPING, a rabbet taken out of the deadwood, for the heels of the timbers to step on. The line that forms its lower part is called the bearding line; it is up to this line that the deadwood partakes of the form of the body (53).

STEPS OF THE MAST (Swedish, *mastespăr*; Dan.

mast-spor; Dutch, *mast-spoor*; German, *spuhr der masten, mast-spuhr*; French, *carlingue du mât*; Italian, *miela d'un albero*; Spanish, *carlinga de palo*; Portuguese, *carlinga dos mastros)* pieces of timber for fixing the heels of the masts in. The main and fore step are fixed across the keelson; the *Main* is made to shift forward and aft, according as it may be desirable to rake the mast; the *Fore* is bolted through the bottom. The mizen step is in general fixed on the lower deck beams. The mortises taken out of them are according to the heeling of the mast (352).

Step for the Capstan (see Capstan).

Steps of the Side (Swedish, *trapp-klampar*; Danish, *trappe-klamper*; Dutch, *trap-klampen*; German, *trepp-klampen*; French, *taquets d'échelle, ou échelon*; Italian, *tacchj per la scala*; Spanish, *passos de escalera*; Portuguese, *cunhos do portaló)* pieces worked with mouldings, and fastened on the ship's side, at the gangway, for the convenience of ascending and descending.

Stern, the part from the wing transom upward, or the posterior face of the ship, or that part which would be presented to view, when behind or astern of the ship, in a line with the keel, and looking forward. The upper part of the stern is called the taffrail, and the boundary or outline of the taffrail is formed by a rail called the taffrail rail. The basis of the stern is the wing transom, at the upper part of which is placed a rail called the tuck rail; above the tuck rail is the lower counter, which is bounded at the upper part by a rail called the lower counter rail; above this rail is the upper counter, which is likewise bounded by a rail at the upper part, called the upper counter rail. This rail forms a basis for the lower tier of lights, which communicates with the wardroom of two and three deck ships, and the captain's cabin in frigates; above these lights, in two and three deck ships, is the balcony; if a three-deck ship, it is the one connected with the admiral's cabin, and is called the lower balcony, middle gallery, or middle walk of the stern, while the one above is called the upper balcony, &c. and is connected with the captain's cabin. In two deck ships it is called the balcony, stern gallery, or stern walk. Above the upper or

stern gallery or lights in frigates, is an arched moulding, called the cove, which forms the lower part of the taffrail. The stern, from the lower balcony upwards, is formed at the sides by pieces called quarter pieces, formerly carved with different figures, but now bounded by a moulding (see GALLERY, COVE, TAFFRAIL, and QUARTER PIECES).

STERN FRAME (41, 42, 43, 44, 45, and 46).

STERN POST (see POST).

STILES (see BULKHEAD).

STIVE, the angle upwards that any timber, &c. makes with the horizon, or what it is elevated above a horizontal line, as the stive of the cathead, bowsprit, &c.

STOOLS (see QUARTERS).

STOPPINGS-UP (see LAUNCH).

STOPPER BOLTS, large ring bolts, driven through the deck and beam, for stoppering the cable to.

STRAKES (Swedish, *găng af plankor*; Danish, *gang af planker*; Dutch, *gang van planken*; German, *gang von planken*; French, *virure de bordages*; Italian, *filaro de tavole*; Spanish, *hilada*; Portuguese, *fiada ou carreira de taboas)* a breadth of plank either within or without board, that ranges from one end of the ship to the other.

Side-binding Strakes or *Letting-down Strakes* (from 250 to 252, and 312).

STRING (170, 171).

SUPPORTERS (see CATHEADS).

SURGE (see CAPSTAN WELPS).

SYPHERED, or CYPHERED (see HARRIS-EDGED).

TABLING (see COAKING).

TAFFRAIL or TAFFAREL (Swedish, *hackebräde*; Danish, *hakkebret*; Dutch, *hakkebord*; German, *hackbord oder hackebord*; French, *couronnement*; Italian, *coronamento*; Spanish, *coronamiento*; Portuguese, *grinalda)* that part of the ship's stern above the cove; it was formerly made of solid fir, and ornamented with carved figures, &c. but now a birthing or planking rabbetted is brought on the aft side of the stern timbers, called the backing, from the head of the lights to the upper part of the quarter deck barricading, and the outline of the taffrail is formed by a moulding which makes a fair curve with the outline of the quarter piece.

TAIL or DOVE-TAIL, the letting in or forming of one piece or timber into another, in a wedge-like form, to prevent their separating.

TENON (Swedish, *tapp, pinne*; Danish, *tap, pind*; Dutch, *pen*; German, *pinne*; French, *tenon*; Italian, *dente, anima*; Spanish, *peon*; Portuguese, *dento, macho, piaom*) the end of one piece diminished, to form shoulders, to fix in the hole of another piece, called the mortise, for uniting and fastening them together.

TERM PIECES or TRUSSES, a kind of cartouzes or pieces of carved work, placed under each end of the cove or lower part of the taffrail. They are placed on the side counter timber, and extend down to the breast or foot space rail of the balcony.

THOLES (Swedish, *tullene*; Danish, *tollene*; Dutch, *dollen*; German, *dullen*; French, *toulets*; Italian, *scarmi*; Spanish, *toletes*; Portuguese, *toletes*) pieces fixed in the gunwales of boats to form the rowlocks.

THROAT, the hollow of any piece, or curved part, that connects the two arms of any knee timber, as the inside at the middle of the transoms, the upper part at the middle of the floors, &c. The hollow of the jaws of the gaff is called the throat of the gaff.

THWARTS (Swedish, *toftar*; Dan. *tofter*; Dutch, *doften, dogten*; German, *duchten oder duften in dem boot in der schlupe*; French, *bancs d'une chaloupe*; Italian, *banchi*; Spanish, *bancos de la lancha*; Portuguese, *bancos*) seats or benches in boats for the rowers, &c.

THWARTSHIPS (see ATHWART).

TILLER or TILLAR (Swedish, *roder pinnen*; Dan. *roerpinden*; Dutch, *roerpen*; German, *ruderpinne*; Fr. *barre du gouvernail*; Italian, *angola, manovella, ribolla*; Spanish, *canna del timon*; Portuguese, *cana do leme*) a lever fixed in the head of the rudder, for turning it when steering.

TIMBER (Swedish, *timmer*; Danish, *tommer*; Dutch, *hout*; German, *holz*; French, *bois*; Ital. *legno*; Spanish, *madera*; Portuguese, *madeira*) is the body of the root, stem, and branches of trees, which is in general designated by the appellation of wood. Timber is in general distinguished into rough, square, or hewn, sided, and con-

verted timber. *Rough Timber* is the timber to the full size, as it is felled, with the lop, top, and bark taken off; *Hewn Timber* is timber squared, as rough timber is squared for measurement, &c. *Sided Timber* is the tree having the full size one way as it is felled; but with the slabs taken off two of its sides, or made straight; the other, so that at the middle of the tree it must be $\frac{1}{8}$ of its depth or siding, more than its siding between the wanes. *Converted Timber* is timber cut for different purposes; it is distinguished into thick stuff, plank, board, carling, and scantling. *Thick Stuff* is from $4\frac{1}{2}$ to 12 inches, *Plank* from $1\frac{1}{2}$ to 4 inches, and *Board* below an inch and $\frac{1}{2}$ in thickness; *Carling* is timber cut to a rectangular form, and above $4\frac{1}{2}$ inches the smallest way; *Scantling*, commonly called quarter, is the same as carling, but has one of its dimensions below $4\frac{1}{2}$ inches. Fir from 3 inches in thickness, downward, is commonly called deal, when sent into the service with the edges taken off, to certain breadths; but if narrow, they are called battens. Fir, when cut from timber in the service, in general takes the name of plank, board, &c. according to its thickness.

Timber of various sorts is used in the construction of the hull, and for the different species of furniture. Principally for the hull, oak, fir, beech, and elm, with now various species of foreign woods; these, with ash and lignum vitæ, are used for the furniture (see Ash, Beech, Elm, Lignum Vitæ, and Oak).

Timbers (Swedish, *inhult*; Danish, *indtömmer*; Dutch, *inhouten*; German, *inholzer*; French, *membres d'un vaisseau*; Italian, *membri d'un vascello*; Spanish, *maderas de la ligazon*; Portuguese, *membros do navio*) a general name given to timbers that compose the frame (65).

Timber and Room (see Room and Space, and Note 29).

Timbers of the Head (see Head).

Timbers of the Truss Frame (285, 286, 287, and 288).

Tonnage. The tonnage of a ship is the capacity the body has for carrying a cargo or weights, or the burthen computed according to any established rule.

The common rule for finding the burthen of ships, or what is called the builder's tonnage, is, to multiply the

extreme breadth into the length, and that product, by $\frac{1}{2}$ the extreme breadth, and the whole product, divided by 94, is the tonnage according to the rule.

The *Length*, or the length for tonnage, is got by making certain deductions, in proportion to the breadth and height of the wing transom, for the rake of the stem and stern post; that is, from the distance between two perpendiculars to the keel, one drawn passing through the fore part of the stem at the height of the hawse holes, and the other through the after part of the stern post at the height of the wing transom; subtract 3-5ths of the extreme breadth for the rake of the stem; and, as many feet as the upper side of the wing transom, at the middle line, is above the upper edge of the keel, deduct so many $2\frac{1}{2}$ inches for the rake of the post, and the remainder is the length of the keel for tonnage; but if the stern post rakes more than $2\frac{1}{2}$ inches in a foot, the perpendiculars are then drawn for the first length, through the fore part of the stem at the under side of the bowsprit and the aft side of the main post at the upper edge of the keel, and a deduction only of 3-5ths of the extreme breadth taken out, for the rake of the stem, neglecting the rake of the post. This last rule for the length of the keel of tonnage is likewise observed, in measuring all ships for tonnage duties, without regarding the rake of the post. The *Breadth* is the breadth to the outside of the timber, with the thickness of the plank of the bottom added on each side.

The foregoing rule gives to all bodies, whatever their capacity, while their length and simple breadth are equal, the same tonnage; to the fullest merchant ship the same as the sharpest cutter.

Probably a more exact rule, of easy application, might be made, by using in the calculation the girth of a vessel taken at the midship section; as this would vary with the degree of fullness or leanness below.

Top and Butt (98).

Topmast and Topgallant Mast (see Mast).

Topside, that part of the ship above the main wales (see Note 26).

Top Timbers, the timbers in the frame that give the form of the topside (66).

Top Timber Line (Note 26).

Trail Boards, the carved work placed between the cheeks, from the lower part of the figure, on the knee of the head.

Transoms (Swedish, *nedra häktbjalkarne*; Danish, *varpen*; Dutch, *worpen*; German, *worpen des platten spiegels*; French, *barres d'arcasse*; Italian, *gue*; Spanish, *puercas, cochinatas*; Portuguese, *gio segundo, terceiro, &c.*) (41 and 42).

Deck Transom (see Deck Transom).

Helm-Port Transom (see Helm-Port Transom).

Wing Transom (Swedish, *häckbalk*; Danish, *hækbielke*; Dutch, *hekbalk*; German, *heck-balken*; French, *lisse d'hourdie ou la grande barre d'arcasse*; Italian, *triganto*; (Venet. *crose*); Spanish, *yugo de la popa, yugo principal*; Portuguese, *gio grande*) (41).

Filling Transom (41).

Transom Knees (see Knees).

Transporting Blocks (see Blocks).

Treenails (Swedish, *naglar*; Danish, *naagler eller nagler*; Dutch, *naagels, nagels*; German, *nagel, hölzerne nagel, nai-nagel*; French, *gournables*; Italian, *caviglie*; Spanish, *cabillas*; Portuguese, *cavilhas*) pins of a cylindrical form, in general of oak of the best quality; they are used for fastening chocks on different timbers, or for slightly fastening different timbers together, but they are principally used for fastening the different planking to the timbers. Treenails vary from one inch to one inch and $\frac{3}{4}$ in diameter, and the different gradations from the smallest to the largest diameters are distinguished by particular marks, and are called by the workmen, one, two, three, four, and five, edlars cross, cross, broad arrow, round O, and round O and spot.

Trestletrees (Swedish, *längsalningar*; Danish, *lang-salinger*; Dutch, *lang-zaalingen*; German, *lang-sahlingen*; French, *longis, barres maitresses de hune*; Italian, *bai*; Spanish, *baos*; Portuguese, *vaos*) (342, 343, and 344).

Tricing Battens, battens for tricing the hammocks up to; they are nailed between the beams under the decks.

Truss (see Terms).

TRUSSED FRAME (284) (see TIMBER and TRUSS PIECES).

Trussed Frame, the resistance it opposes (291 to 296).

TRUSS PIECES TO THE DIAGONAL OF TRUSSED FRAME (290).

TRYSAIL Gaff (452).

TRYSAIL MAST (453).

TUCK, where the after extremities of exterior planking ends, either on the wing transom or against the tuck timber.

Round-Aft or *Square Tuck* (from 47 to 51).

TUCK RAIL (see RAILS and STERN).

TUMBLING HOME, or FALLING HOME, what the topside is inclined inwards, from a vertical line drawn through the main breadth, or what it is within a perpendicular to the transverse axis.

UPPER DECK (see DECK).

UPPER WORKS (1) (see HULL).

WAIST (Swedish, *keulen*; Danish, *kulen*; Dutch, *kuil*; German, *kuhl des schiffes*; French, *coursive*; Italian, *pozzo*; Spanish, *plaza de armas*; Portuguese, *couves*) that part of the topside between the main and fore drifts (108) that is above the upper deck.

WAIST RAILS (see RAILS)

WALES (Swedish, *berghulterna*; Danish, *berkholter*; Dutch, *berghouten*; German, *berghölzer*; French, *preceintes, cintes, carreaux*; Italian, *cinte*; Spanish, *cintas*; Portuguese, *cintas*) (102 and 103).

Main Wales (Swedish, *stora eller understa berghultet*; Danish, *store bergholtet*; Dutch, *het groote berghout*; German, *das grosse bergholz*; French, *grande preceinte*; Italian, *cinta della prima coperta, cinta della boca*; Spanish, *cinta de la manga, cinta primera*; Portuguese, *cinta grande, cinta do grasso*) (114 and 115).

Middle Wales, or Sheer Wales (118 and 119).

Channel Wale (116 and 117).

WASH BOARDS UNDER THE CHEEKS (Swedish, *bräder under gallionsknün at for hindra störtningen af sjön*; Danish, *gallion bræder*; Dutch, *blaasbalk*; Germ. *blasebalken*; French, *tambour d'éperon, mouchoir ou*

remplissage sous les jottereaux; Italian, *battimare;* Span. *batidero;* Portuguese, *chapuzes das curvas do beque)* solid pieces brought under the lower part of the cheeks of the head, with their outer parts lying obliquely, from the outer part of the cheek to the bow, for breaking the sea off from the under side of the cheek when the ship pitches. Wash boards, sometimes called weather boards, are likewise shifting strakes made to fix into the gunwale or topside of small vessels or boats occasionally to keep the sea out.

Waterways (Swed. *vaterbordsplankar*; Danish, *livholter*; Dutch, *waater-borden, waatergangen*; German, *leibhölzer*; French, *gouttières*; Italian, *trincanili*; Span. *trancaniles*; Port. *toboas dos trincanizes*) (237 and 238).

Thin Waterways (239 to 241).

Thick Waterways. (242 to 249).

Wedges of the Mast (Swedish, *mastkilar;* Danish, *mastkiler*; Dutch, *vystingen, mastkeggen*; German, *masten-kiele*; French, *coins des mâts*; Italian, *conj degli alberi*; Span. *cunnas del palo*; Portuguese, *cunhos dos mastros)* wedges of fir driven between the mast and the partners; they circumscribe the mast, and are from 10 to 14 inches above the partners; at their head or upper end, they are in general from one inch to one inch and a ½ larger than at the partners; and are caulked.

Welps or Whelps (see Capstan).

Wheel, or Steering Wheel, a wheel for obtaining the power on the tiller when steering.

Winch (Swedish, *dräyare;* Danish, *dreier;* Dutch, *draajer, hand-vat;* German, *dreher;* French, *manivelle;* Italian, *manubrio;* Spanish, *ciguenna;* Portuguese, *manivella, manubrio)* a machine used for more powerfully applying different ropes, in general in cutters and small vessels; it is formed of two conical pieces of wood, united to an iron spindle, which forms its axis, and works in two rhodens or gudgeons; the power is applied by two cranks.

Windlass (Swedish, *brädspel;* Danish, *bradspil;* Dut. *braadspit;* Germ. *bratspill;* Fr. *vindas, virevant;* Ital. *mulinello;* Span. *molinete;* Port. *molinete, ou bolinete)* a machine used in small vessels, instead of a capstan, for heaving up the anchor, &c. The windlass is fixed between the carrick bitts; it is in general formed of one

large piece of oak of an octagonal form, which has an iron spindle driven into each end with their centers very accurately in a right line so as to form the axis; these spindles are kept in their places by a bolt in each, that passes through them and the barrel. At the middle and sometimes at each end is fixed a plate or hoop with teeth, called the ratchet or paul plate, or hoop for the pauls, which is of iron, and fixed to the paul bitts; and sometimes carrick bitts, to catch in to prevent the return when heaving a heavy strain, or charged with the effort of the cable. The spindles work in brass rhodens or gudgeons, fixed to the carrick bitts, and the common way of obtaining the power is by handspikes, which are fixed in holes or mortises cut through the barrel for the purpose. The power is obtained sometimes by a tooth wheel and pinion, and applied upon a crank attached to the pinion.

Wing Transom (see Transom).

Wood (see Timber).

Woodlock, a chock put in the throating or score of the pintle, above the load water line, or as near to it as possible; to prevent the rudder from rising, one end abutts under the lower side of the brace and the other against the score. The woodlock is in general coppered over.

Wrung Heads, a name given formerly to the floor heads at that part of the body beside the knee which is in contact with the supporting surface when the body takes the ground (see Floor Heads).

Xebec (Swedish, *chebeque;* Danish, *schierbek;* Dutch, *schebeck;* German, *schebecke;* French, *chébec;* Italian, *sciambecco;* Spanish, *jabeque;* Portuguese, *xabeco)* a small vessel with three masts, with the sails mostly similar to those of the polacre, but furnished with lateen as well as square yards, which are used according to the point of sailing, and the state of the weather. These vessels are navigated on the coast of Spain, Portugal, and Barbary.

Yachts, vessels of state or accommodation.

Yard (Swedish, *rä;* Danish, *raa eller ræ;* Dutch, *raa of ree;* German, *rah oder raa;* French, *vergue;* Italian, *pennone;* Spanish, *verga;* Portuguese, *verga)* (418 and 419).

Lower Yards. Main Yard (Swedish, *stor rån;* Danish, *store raaen;* Dutch, *de groote raa;* German, *die grosse raa;* French, *la grande vergue;* Italian, *pennone di maestra;* Spanish, *verga mayor;* Portuguese, *verga grande)* and *Fore Yard* (Swedish, *fock ran;* Danish, *fok ræen;* Dutch, *de fokke raa;* German, *die fock-raa;* Fr. *la vergue de misaine;* Italian, *pennone di trinchetto;* Spanish, *verga de trinquete;* Portuguese, *verga do traquete)* (from 420 to 426).

Topsail Yards. Main (Swedish, *stormărs-ran;* Danish, *store mærs-raaen;* Dutch, *de groote mars-raa;* German, *die grosse mars-raa;* French, *la vergue de grande hunier;* Italian, *pennone di gabbia;* Spanish, *verga de gabia;* Portuguese, *verga de gabia)*: *Fore* (Swedish, *for mäs-răn;* Danish, *for mærs-raaen;* Dutch, *de voor mars raa;* German, *die vor-mars-raa;* French, *la vergue du petit hunier;* Italian, *pennone di parrochetto;* Spanish, *verga de velacho;* Portuguese, *verga do velacho)*: and *Mizen* (Swedish, *kryss ran*; Danish, *kryds-raaen*; Dutch, *de kruis-raa*; German, *die kreuz-raa*; French, *vergue de perroquet de fouge*; Italian, *pennone di contramezzana*; Spanish, *verga de sobre-mesana*; Portuguese, *verga da gata)* (from 427 to 431).

Topgallant Yards. Main (Swedish, *stor-brüm-răn*; Danish, *store-bram-raaen*; Dutch, *de groote bram-raa*; German, *die grosse bramm-raa*; Fr. *la vergue de grand perroquet*; Italian, *pennone di pappafico di maestra*; Spanish, *verga de juanete mayor*; Portuguese, *verga do joanete grande)*: *Fore* (Swedish, *för bram răn*; Danish, *for-bram raaen*; Dutch, *de voor-bram-raa*; German, *die vor-bram-raa*; French, *la vergue de petit perroquet*; Italian, *pennone di pappafico di parrochetto*; Spanish, *verga del juanete de velacho*; Portuguese, *verga do joanete de proa)*: and *Mizen* (Swedish, *krys-bram-ran*; Danish, *boven-kryds-raaen*; Dutch, *de boven-kruis-raa*; German, *die kreuz-bram-raa*; French, *vergue de perruche*; Italian, *pennone del belvedere*; Spanish, *verga de periquito*; Portuguese, *verga da sobregata)* (437 and 438).

Royal Yards. Main (Swedish, *stor bofven-bram-ran*; Danish, *store-boven-bram-raaen*; Dutch, *de groote boven-bram-raa*; German, *die grosse ober bram-raa*; Fr.

la vergue de grand perroquet volant; Italian, *pennone di contra pappafico di maestra*; Spanish, *verga de sobrejuanete mayor*; Portuguese, *verga do sobrejoanete grande)*: *Fore* (Swedish, *för-bofven-bram-rån*; Danish, *for boven-bram-raaen*; Dutch, *de voor-boven-bram-raa*; German, *die vor-ober-bram-raa*; French, *la vergue du petit perroquet volant*; Italian, *pennone di contrapappafico di parrochetto*; Spanish, *verga del sobrejuanete de velacho*; Portuguese, *vergilha do sobrejoanete de proa)* (439).

Cross-Jack Yard (Swedish, *begine rån*; Danish, *beginne-raaen*; Dutch, *de bagyn-raa*; German, *die bagien-raa*; French, *vergue seche, vergue barrée, vergue de fougue*; Italian, *pennone di fuoco*; Spanish, *verga seca, verga de gata*; Portuguese, *verga seca)* (from 432 to 434).

Spritsail Yard (Swedish, *blind-ran*; Danish, *blinde raaen*; Dutch, *de blinde raa*; German, *die blinde-raa*; French, *vergue de civadière*; Italian, *pennone di civada*; Spanish, *verga de cebadera*; Portuguese, *verga da cevadeira)* (435 and 436).

Studding-sail Yards (Swedish, *läseglets rån*; Dan. *læ-sejls-raaen*; Dutch, *lee-zeils-raa*; German, *leesegel-raa*; French, *vergue des bonnettes*; Italian, *pennone di cortelazzo*; Spanish, *verga de ala*; Portuguese, *verga do cutello)* (441).

YAWL (Swedish, *julle*; Danish, *jolle*; Dutch, *jol*; German, *jolle*; French, *canot*; Italian, *barca*; Spanish, *barca*; Portuguese, *hum bote)* (see BOAT).

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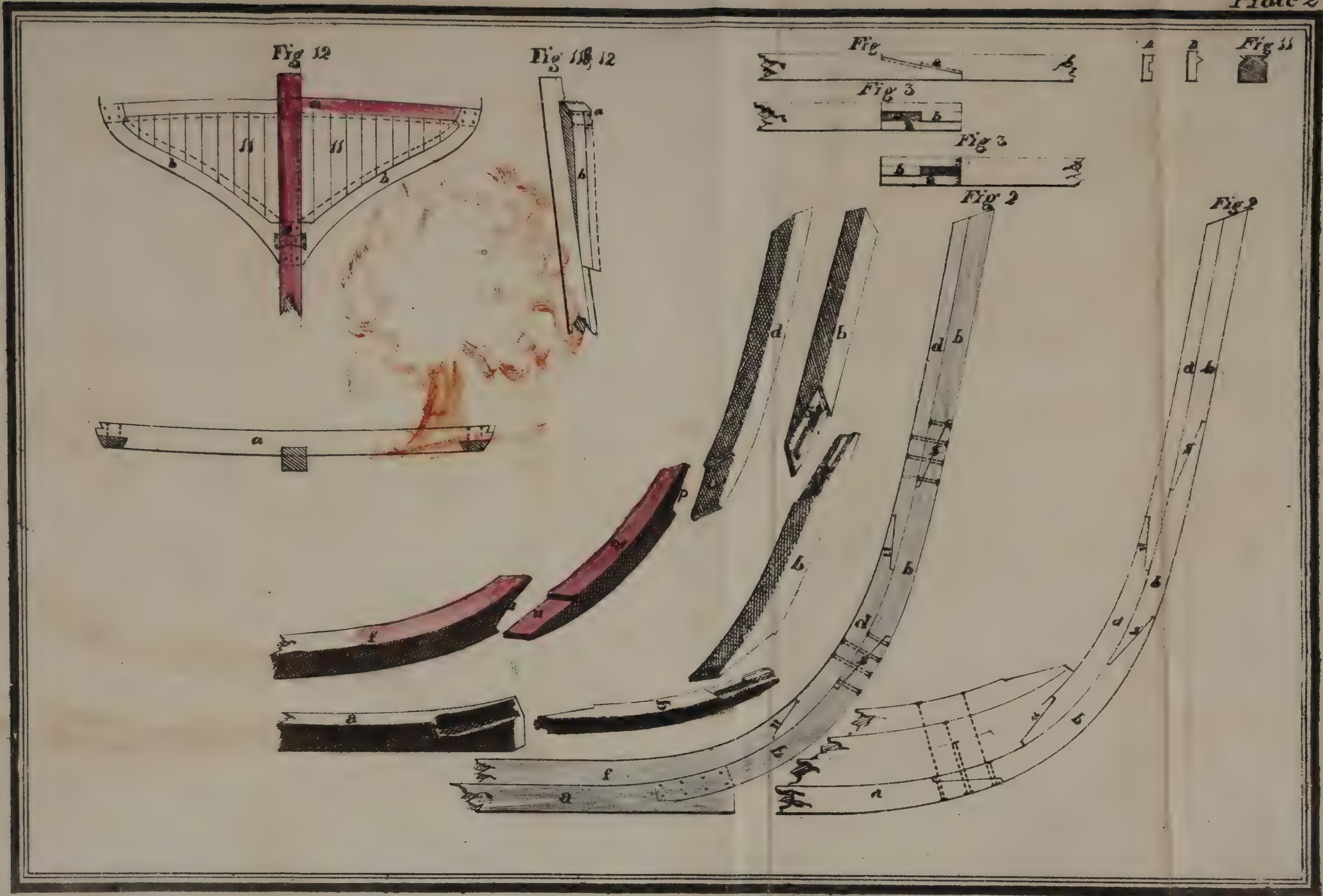
Fig 12
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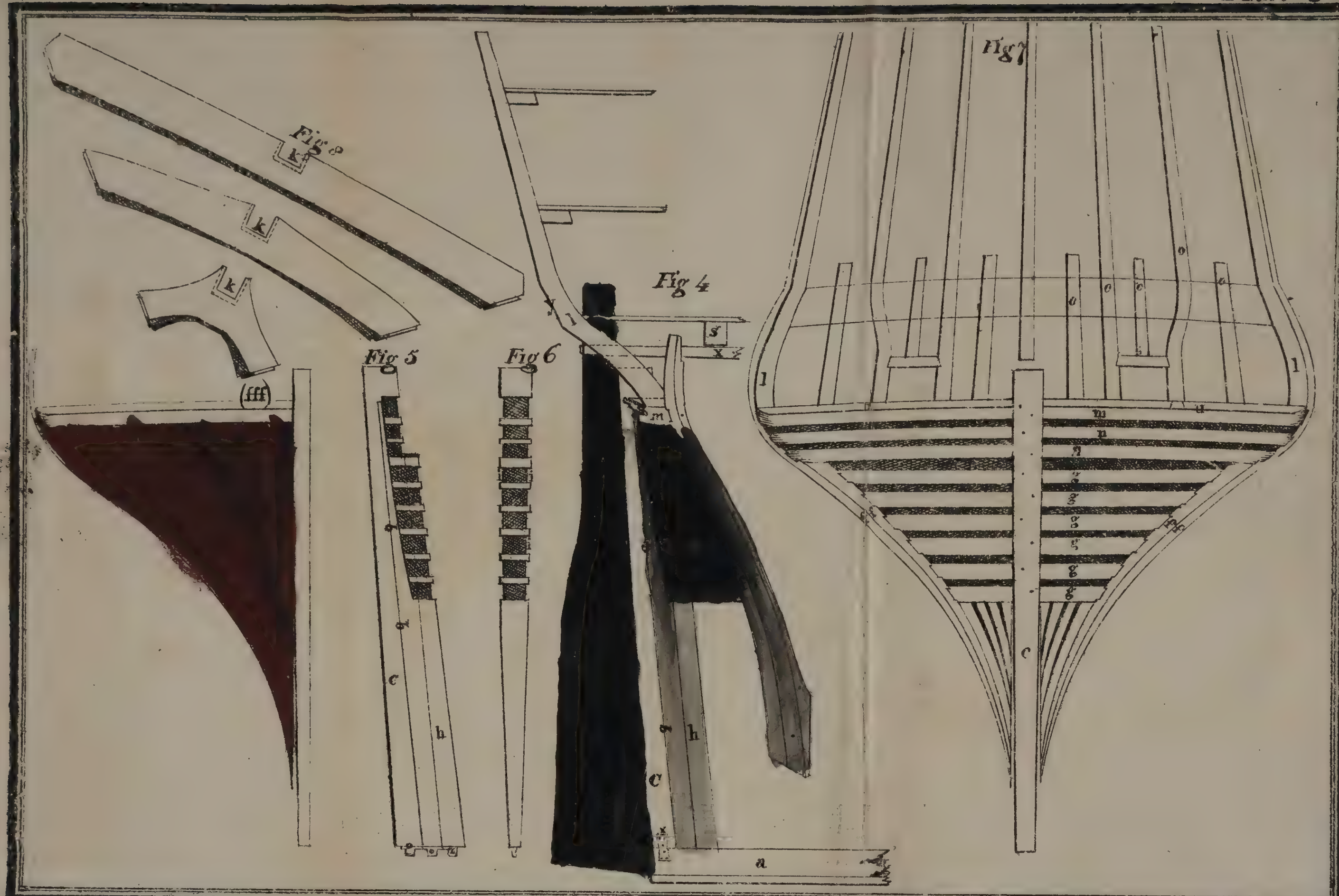
Fig 11

Plate 3



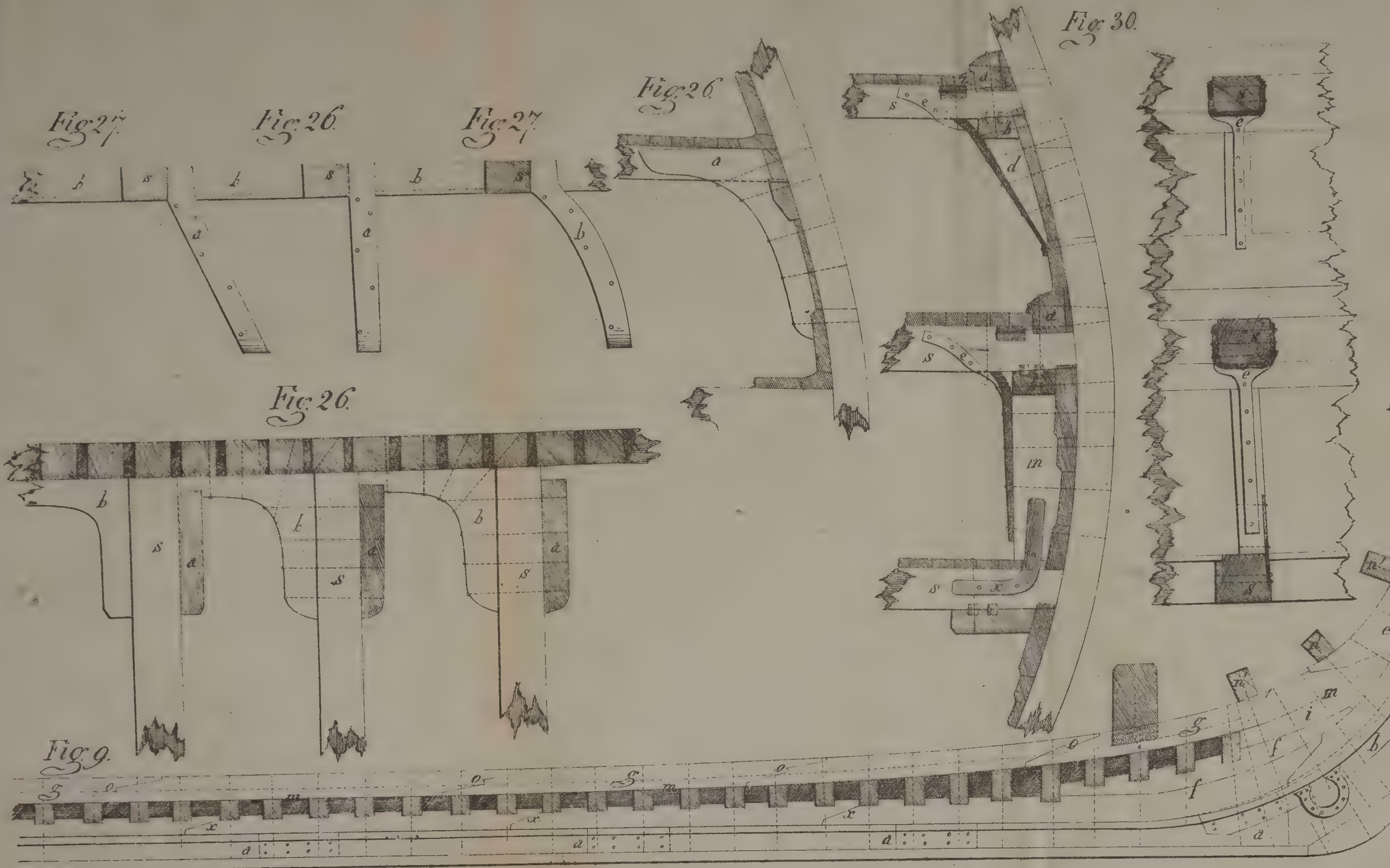

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Fig. 9.

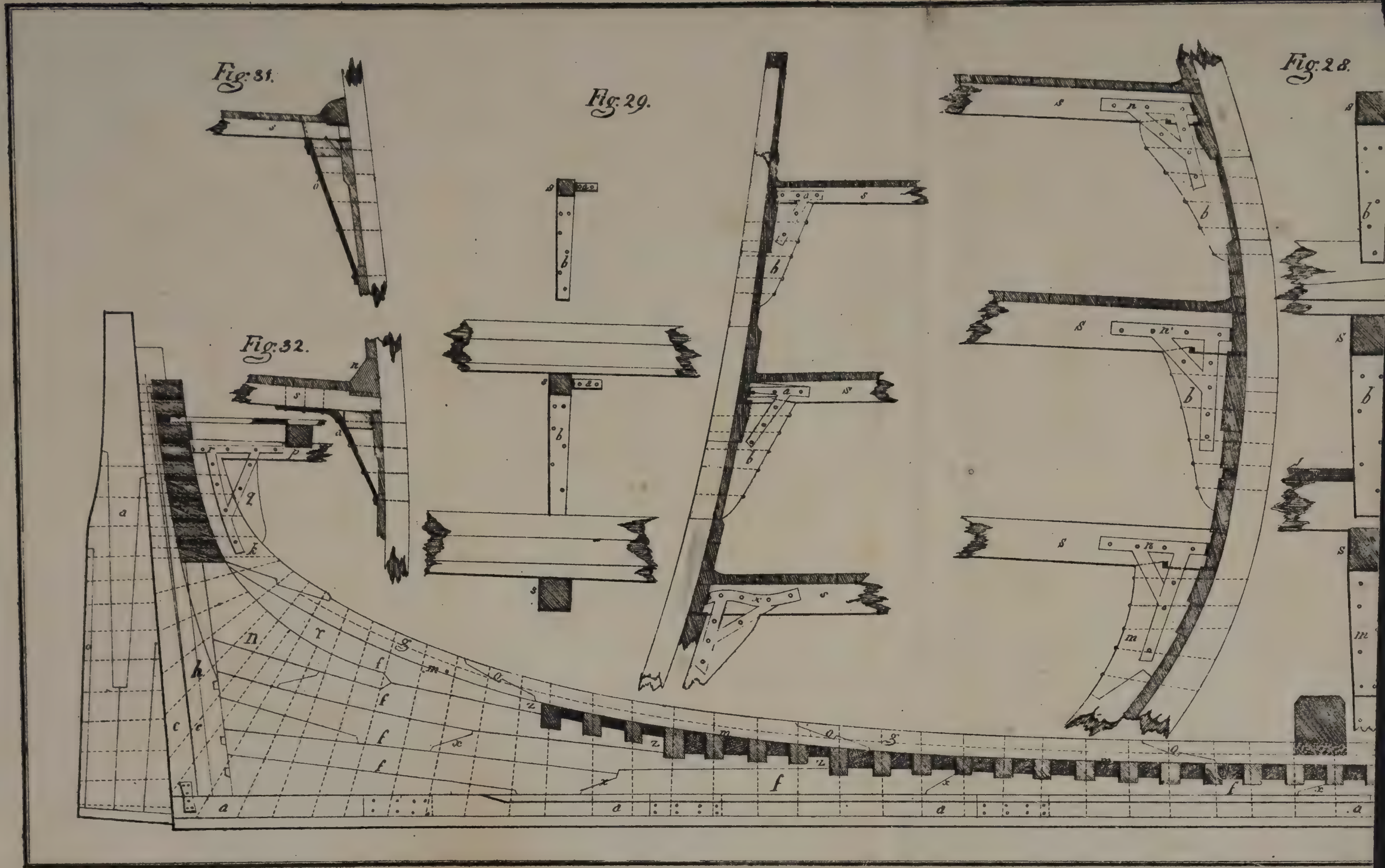
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Fig 17.

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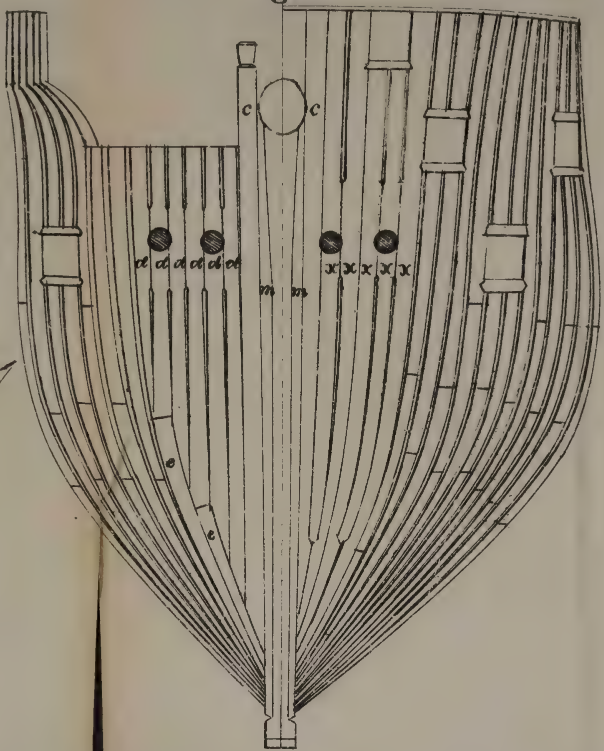

Fig 19.

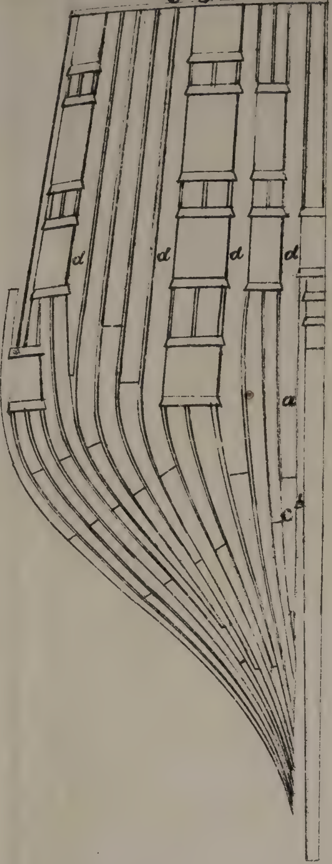

Fig 20.

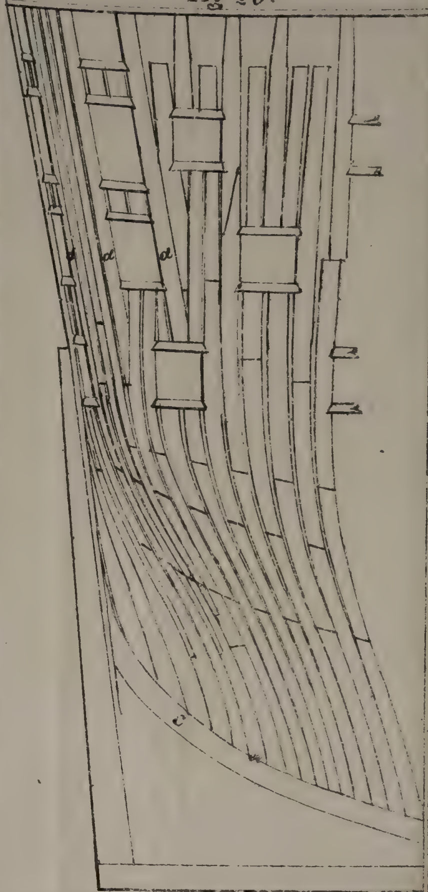

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Fig 23.

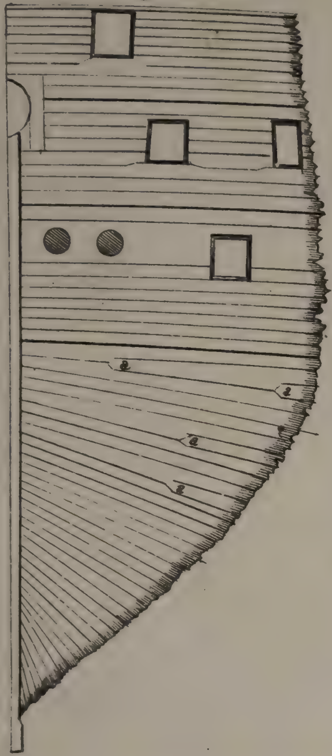

Fig 24.

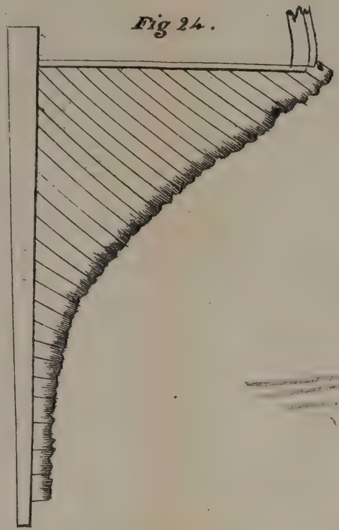

Fig 25.

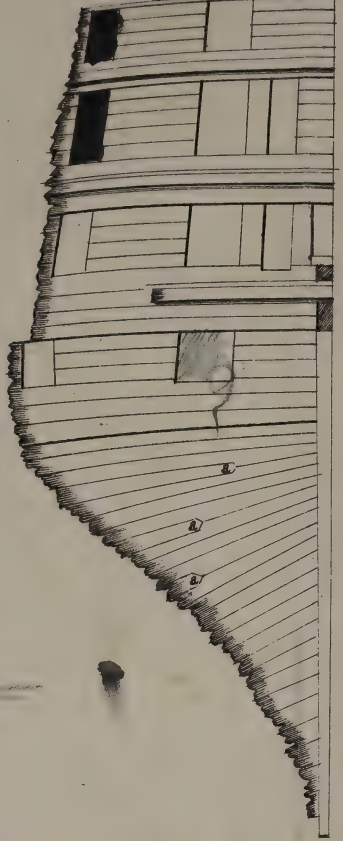

Fig 26.

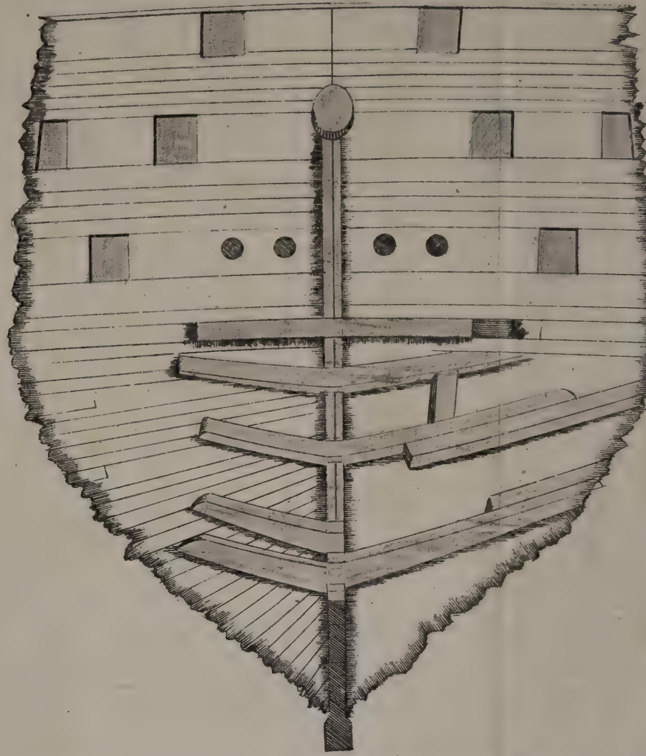

Fig. 21

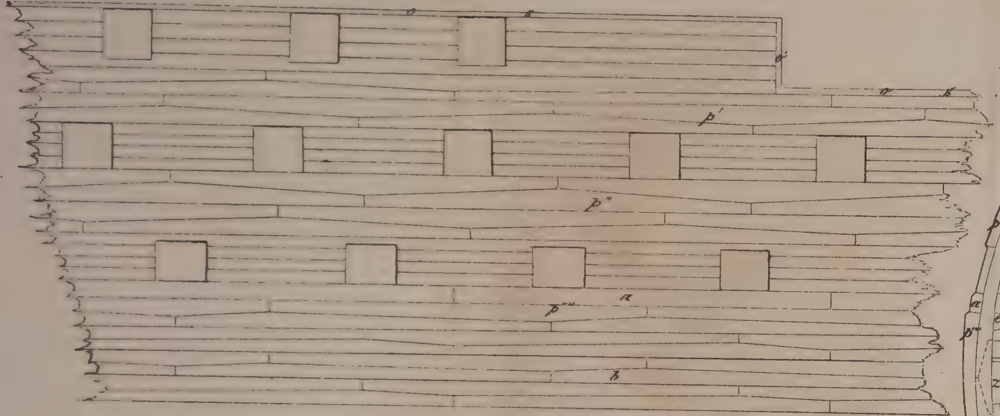

Fig. 25

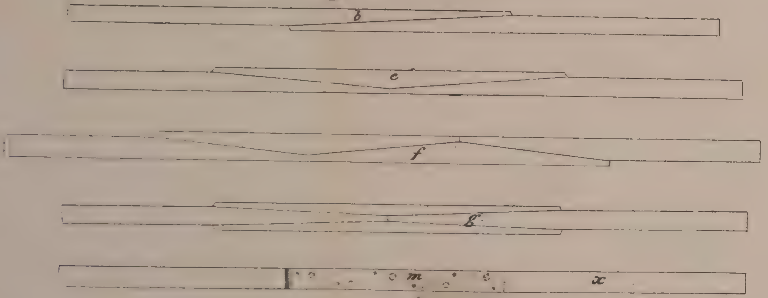

Fig. 10

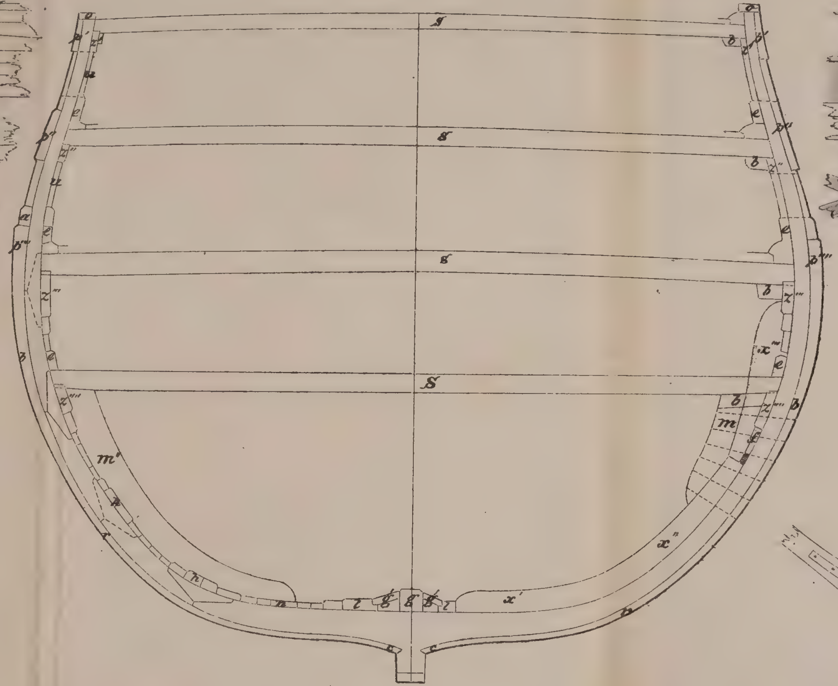

Fig. 22

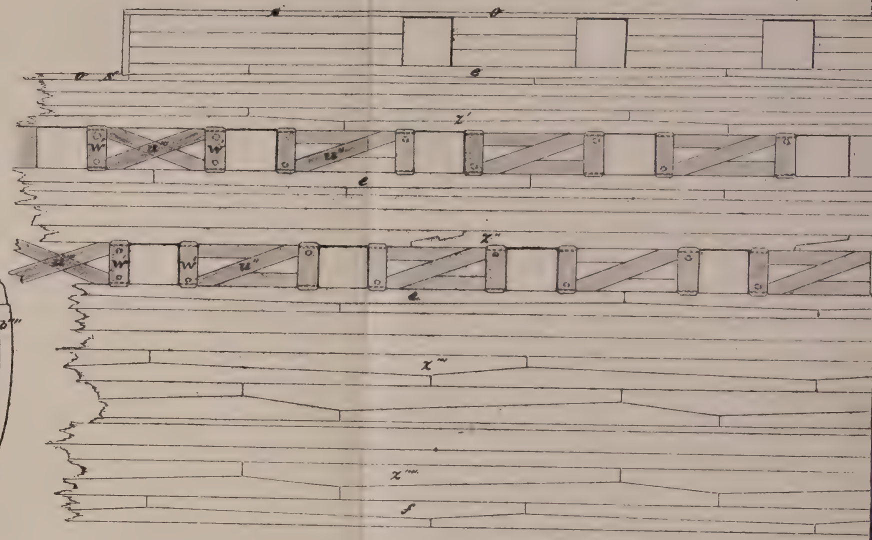

Fig. 34

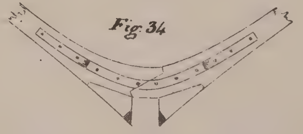

Fig. 35